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ANNOUNCEMENTS

ERRATA

The outside cover of the fall/winter issue of *The Wyoming Archaeologist* had the wrong issue number. That issue should have been Volume 33(3-4). All references on the inside of the issue are correct.

PRYOR-STEMMED TOOLS: TWISTED TECHNOLOGY ON THE HIGH PLAINS

by
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ABSTRACT

The end of the Paleoindian period is characterized by the appearance of several stone artifact types on the High Plains. One of these, the Pryor-Stemmed point, is evaluated here in an attempt to establish regional homogeneity among artifacts of this unique cultural complex. Pryor-Stemmed tools from Pathfinder Reservoir, Wyoming are statistically compared with those from other Wyoming locations. Common trends in modal clustering suggest technological affinities but statistical evaluation by groups yielded inconclusive results. Additionally, polymodal distributions for measures of edge angle, blade width, and hafting element imply the possibility of Pryor-Stemmed being a multi-functional tool.

INTRODUCTION

Radiocarbon dates (Table 1) indicate the tenure of the Pryor-Stemmed cultural complex from known *in situ* components. The range of this chronology spans almost a thousand years [excluding the Fourth of July Valley site (Benedict 1981) date, which is apparently anomalous] and occurs at the boundary of the Paleoindian and Early Plains Archaic periods (Frison 1978). While Pryor-Stemmed artifacts are generally recognized as a Paleoindian type (largely because of basal grinding), those who made and used them are known from the archaeological record (Husted 1965, 1969; Frison 1973, 1976, 1978; Frison and Grey 1980) to have practiced a more archaic form of subsistence, relying on and utilizing resources of varying diversity. Simple grinding tools appear in Pryor-Stemmed sites and proliferate during the following Altithermal (Antevs 1948) period. Intensive gathering and conserving is suggested by seed quantities and possible storage pits exposed at Schiffer Cave and others (Frison 1973).

Pryor-Stemmed artifacts are named for those found during excavation of the type sites, Bottleneck Cave and the Sorenson site (Husted 1969), located on the Bighorn River. The former site is located in Montana, the latter is on the Wyoming side of the line. These unique tools were first recovered from a rock shelter on the Middle Fork of the Powder River (48JO303) excavated by the Wyoming Archaeological Society in the late 1950s (Haynes et al. 1966). At that time, they were misidentified as Meserve-Dalton because of certain shared similarities.

Subsequently, the Pryor-Stemmed type was found at Schiffer Cave (48JO319) on the North Fork of Powder River in 1970 (Frison 1973), at Medicine Lodge Creek (48BH499) in 1971 (Frison 1978), and at Paint Rock V, east of the Medicine Lodge Creek site (Frison 1976). Isolated occurrences of these unique tools at sites in south-central Wyoming have also been reported (Miller 1979, 1986).

Perhaps some of the best data for Pryor-Stemmed artifacts are available in private surface collections. These artifacts are known to occur in collections from southern Montana to southern Wyoming with occasional manifestations in west-central Wyoming. A significant concentration of Pryor-Stemmed material has been collected from the Pathfinder Reservoir area on the North Platte River (Fig. 1).

A projectile recovered from the Fourth of July Valley site (Benedict 1981) is well within the range of Pryor-Stemmed variation but a radiocarbon

SITE NAME (NUMBER)	DATE	LAB NO.
Bottleneck Cave (24BH206)		
Occupation III	8160±180 (6210 B.C.)	SI-240
Occupation II	8040±200 (6090 B.C.)	SI-241
Sorenson Cave (24CB202)		
Occupation III	7560±250 (5610 B.C.)	SI-689
Medicine Lodge Creek (48BH499)		
	8340±220 (6390 B.C.)	RL-151
	8160±220 (6210 B.C.)	RL-380
48J0303	7800±110 (5850 B.C.)	A-484
Paintrock V (48BH349)	8140±150 (6190 B.C.)	RL-391
	8340±160 (6390 B.C.)	RL-381
Schiffer Cave (48J0319)	8360±160 (6550 B.C.)	RL-100
	8500±160 (6550 B.C.)	RL-99
Fourth of July Valley, Colorado		
	5960±85 (4010 B.C.)	no number given

Table 1: Pryor-Stemmed radiocarbon dates.

date of 5960±85 B.P. for this site is inconsistent with other Pryor-Stemmed dates (Table l). Rock shelters recently excavated near Guernsey, Wyoming yielded artifact material believed to be Pryor-Stemmed. No radiocarbon date is available as yet but the artifacts were chronologically bracketed placing them between Paleoindian period and Middle Plains Archaic (George Zeimens, personal communication, 1990).

As new sites are revealed, it becomes obvious that this unique cultural complex is more widely distributed than was earlier believed. Pryor-Stemmed tools have been described elsewhere (Husted 1969; Frison 1973; Frison & Grey 1980). To these descriptions it should be added that a chisel-like distal point is most often present and results from the characteristic unifacial resharpening technique (Figure 2c).

As is common among other diagnostic artifact types, significant variation is recognized in Pryor-Stemmed alternate-beveled tools (Figure 3). Site 48JO303 (Haynes et al. 1966) yielded a diverse assemblage of Pryor-Stemmed material (see Frison and Grey 1980:31). Lanceolate forms occur with stemmed forms at this site, Schiffer Cave (Frison 1973), Paint Rock V, and at the Medicine Lodge Creek site (Frison 1978). From the drawings of these materials (Frison and Grey 1980), it becomes obvious that the term "stemmed" is a misnomer, at least with respect to the collections from Big Horn Mountain caves.

The lanceolate forms no doubt occur in surface collections as well. However, they, and certain of the stemmed types, can be easily confused with McKean variants with which certain morphological traits are shared. As a result, it is likely that certain lanceolate surface finds have been misidentified.

The focus of this paper is the Pathfinder Reservoir surface collections (n=28) (Figures 4, 5). Data taken from these materials will be compared to data from a combined sample from west-central Wyoming and from the Seminoe Reservoir-West Hanna Basin, Wyoming (n=10) (Figure 6). This will be to test the hypothesis that all are homogeneous with respect to metric attributes. If the unique blade shape was task-specific, such specificity should be reflected in acceptance of the null hypothesis that (Ho: $\mu 1-\mu 2 \leq 0$) based on comparisons of blade width (BW), haft element (HE), and edge angle (EA) between the two groups. That is to say: the mean for each measurement in the Pathfinder sample is not significantly different from the mean for the same measurement in the "all other" sample. If varying blade widths resulting from repeated resharpening influenced the user to apply different blade sizes to different tasks, their distribution could be reflected polymodal-

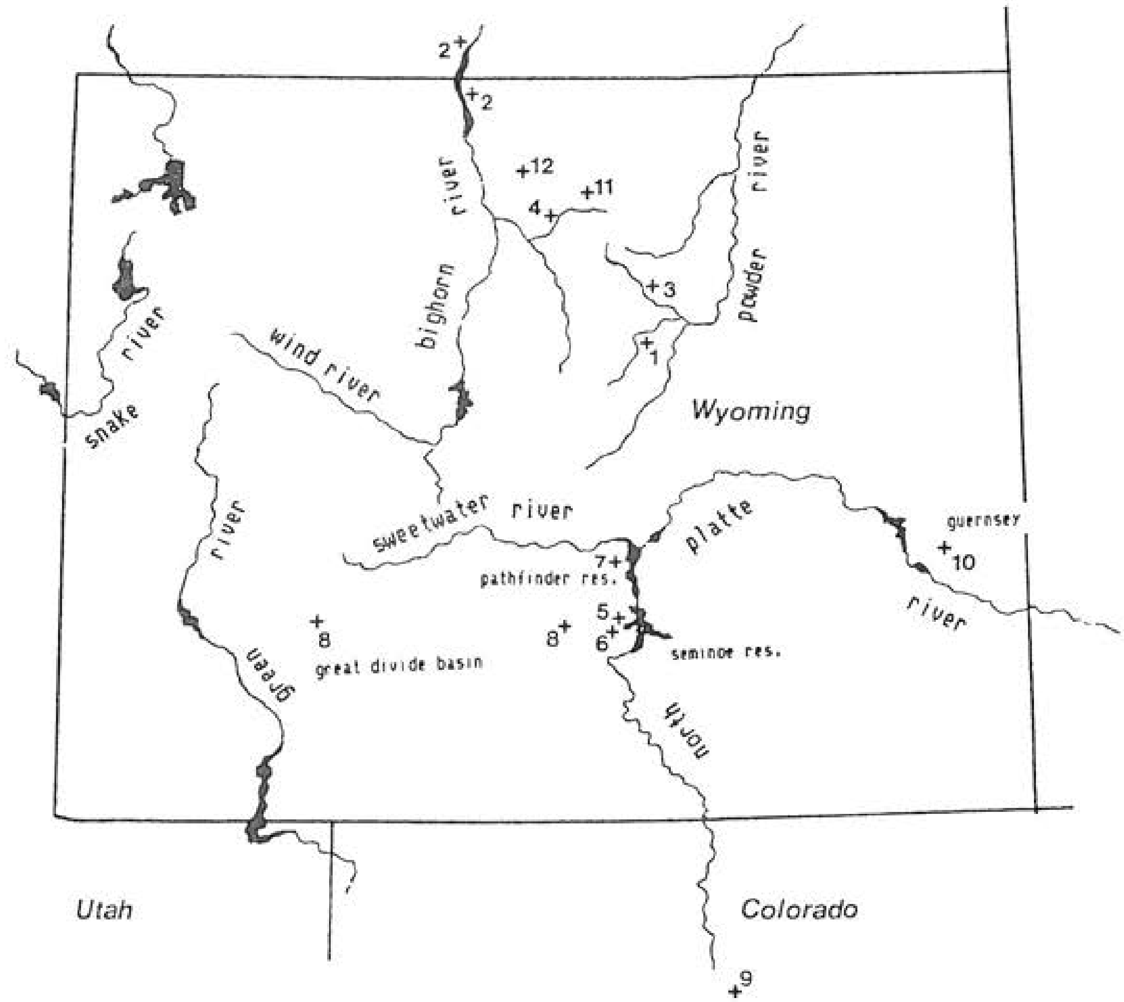


Figure 1: Pryor-Stemmed artifact locality map, showing locations referred to in present study. 1 = 48JO303; 2 = Bighorn Canyon sites; 3 = Schiffer Cave; 4 = Medicine Lodge Creek; 5 = Seminoe Beach site; 6 = Coal Creek site; 7 = Pathfinder Reservoir; 8 = isolated surface finds; 9 = Fourth of July Valley site; 10 = Bass-Anderson Cave; 11 = Paint Rock V; 12 = Hanson site.

ly when plotted in histogram form. In evaluating differences in Dalton point blade widths, Goodyear (1974) observed a trimodal distribution of widths, which was attributed to a ". . . regular, consistent set of resharpening practices . . ." (Goodyear 1974:21). Such should be the case with Pryor-Stemmed.

If varied blade widths suggest varying tasks, then the hafting method should compensate for different pressures by also being task specific. In this regard, a reasonable correlation should be present between the hafting element and the width of blade.

General configuration of certain Pryor-Stemmed units, especially those in later stages of attrition, suggest their possible use in drilling functions. Redfield (n.d.) made a similar observation with respect to investigation of Dalton points from Arkansas. The hypothesis that Pryor-Stemmed tools could have been used for boring out the socketed end of atlatl mainshafts is explored. Because of the paucity of Paleoindian

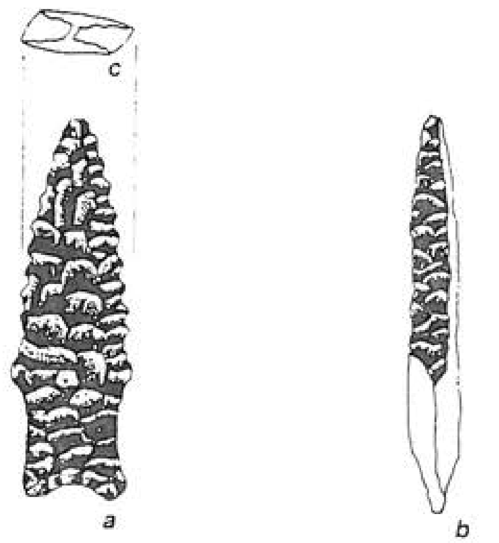
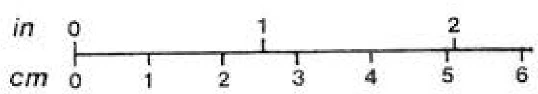


Figure 2: Morphology of a commonly occurring Pryor-Stemmed tool. a = face; b = side view; c = distal end view.



period perishables (e.g., foreshafts and mainshafts), materials of Late Archaic age from Daugherty and Spring Creek Caves (Frison 1978), located in the Big Horn Mountains of Wyoming, were used to suggest whether a correlation existed.

METHODS

Eleven measurements (Figure 7) were taken using metric sliding calipers and recorded in millimeters. Edge angles were calculated by taking two measurements from each blade edge. The four indices for each tool were then averaged to arrive at one angle index for each artifact. Certain authors use opposing terminology in description of projectile attributes (Syms 1969; Thomas 1986). To evaluate measurements presented here, "proximal" is the end of the tool with the hafting element. The "distal" extremity is the opposite or pointed end. On certain tools a small portion of the distal end is missing. The maximum length (ML) on these tools was projected on the basis of bilateral symmetry for purposes of evaluating the correlation of these points with dimensions of bored cones in atlatl mainshafts and/or tapered ends of foreshafts.

The following sources were used to accumulate raw data: (PA) Sternberg

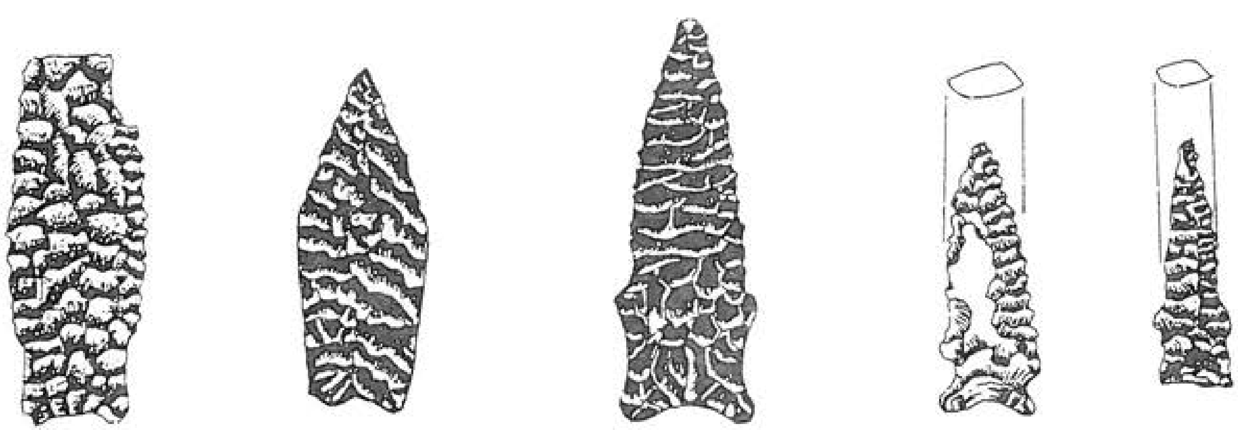


Figure 3: Pryor-Stemmed tools showing partial range of variability. Lanceolate form is lenticular in cross-section.

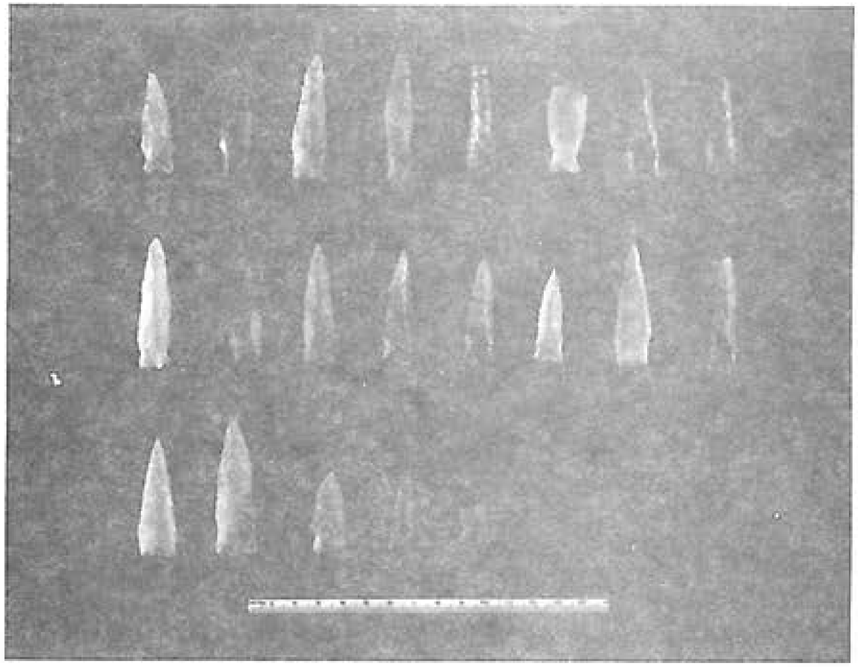


Figure 4: Pryor-Stemmed tools from the Sternberg collection.

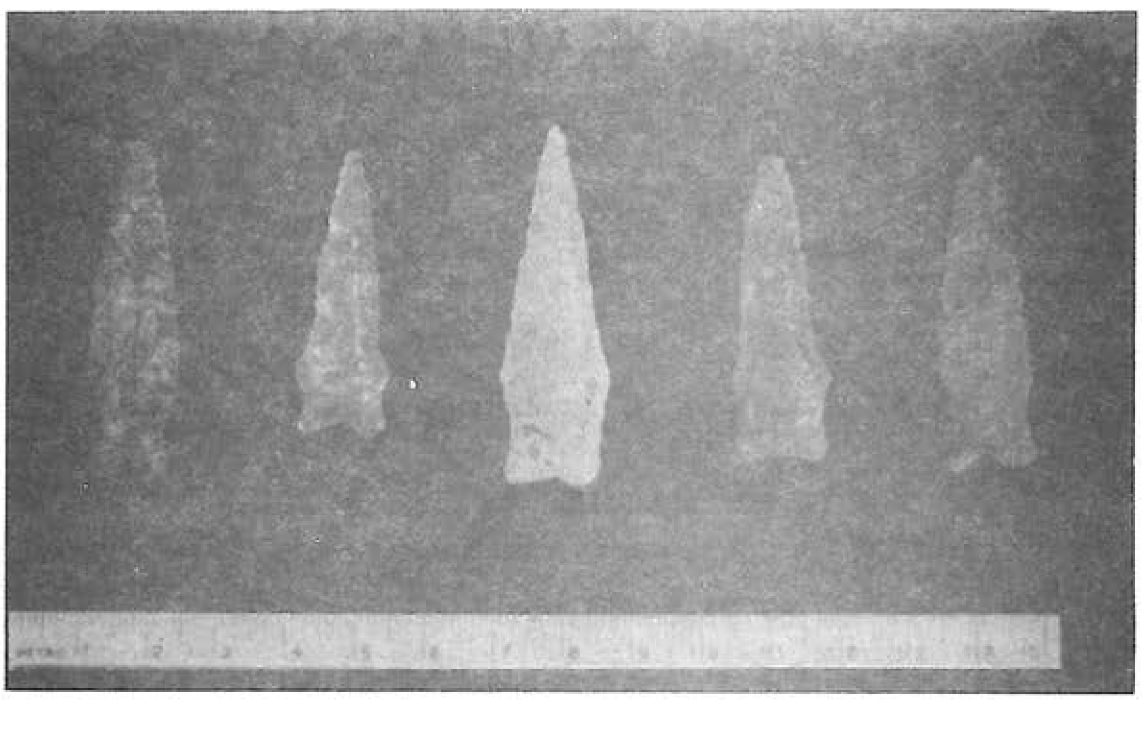


Figure 5: Pryor-Stemmed tools from the Conner collection.

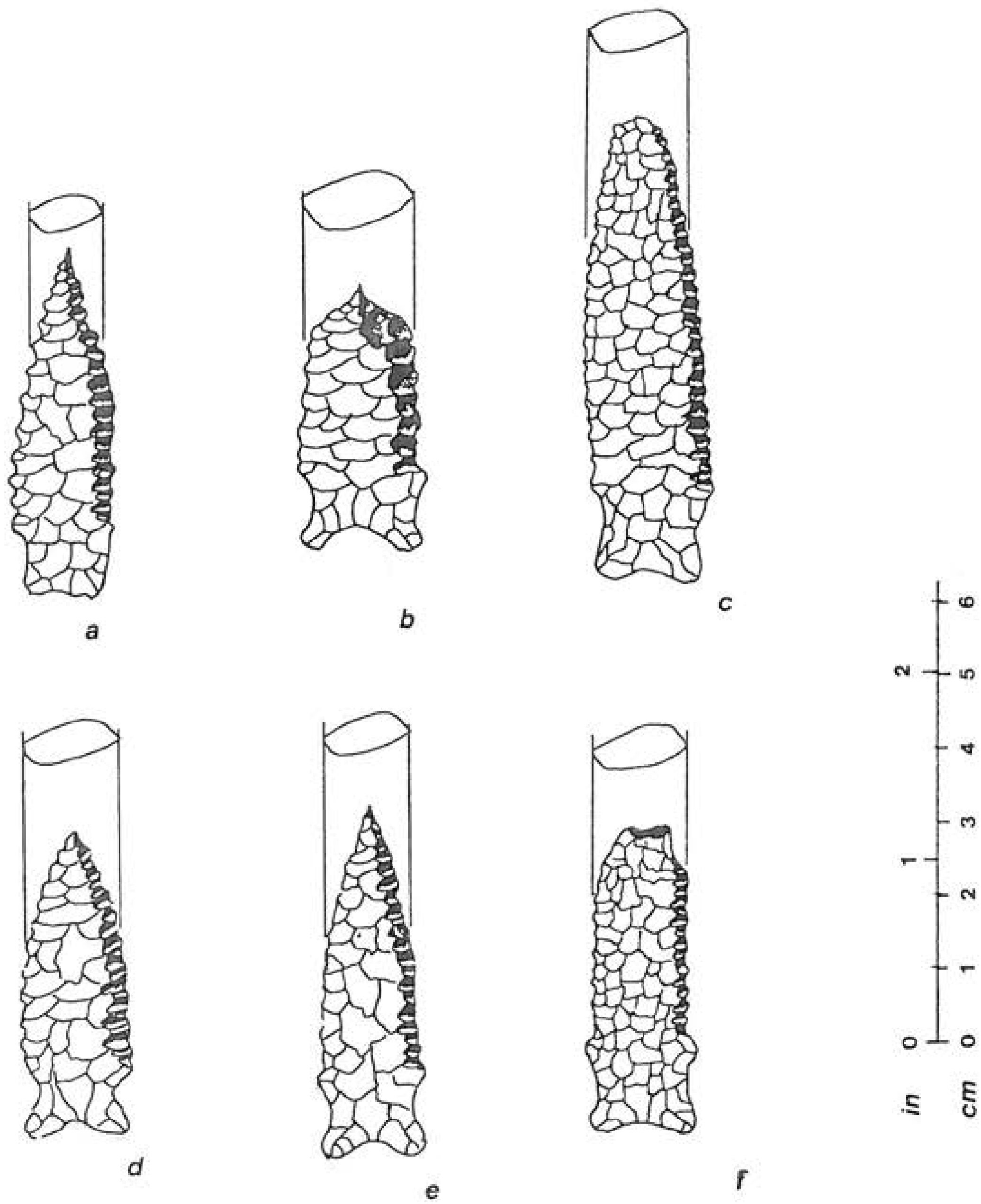


Figure 6: Pryor-Stemmed tools. Tools are shown to scale, but flaking patterns are not intended to duplicate originals. a,e = Hanna Basin; b,d = Seminoe Beach site; c = Bass Anderson Cave; f = Great Divide Basin.

collection, (PB) Conner collection, (RD) Red Desert collection, (DL) Delozier collection, (SC) Scoggin collection, (MI) Miller collection, (BA) Bass-Anderson site, (WY) State of Wyoming collections.

Table 2 provides metric data for all the artifacts included in the study. Statistical analyses were performed using the <u>QUICKSTAT</u> (Bonett 1989) program on an Epson 386/20 computer.

CATNO	LT	OR	PC	RA	EAa	EAb	EA	ML	BW	BL	BT	HL	HWP	HWD	HE
001	CH	PA	01	13	69	70	69.5	41.8	11.4	31.6	6.3	10.2	12.5	14.3	10.8
002	CH	PA	02	--	69	71	70.0	----	13.0	----	5.8	12.8	11.5	13.6	10.3
003	QE	PA	01	10	71	72	71.5	51.4	12.5	40.4	6.8	11.0	13.3	15.5	12.7
004	QE	PA	02	07	68	65	66.5	53.0	10.5	38.4	5.8	14.6	11.5	10.3	9.6
005	CH	PA	03	--	75	77	76.0	----	7.6	----	6.9	10.8	13.3	13.0	10.6
006	CH	PA	03	--	57	59	58.0	----	14.8	----	6.4	13.6	13.0	15.4	10.2
007	QE	PA	01	12	60	61	60.5	43.9	11.0	33.6	5.4	10.3	13.7	13.7	11.7
008	CH	PA	02	--	59	63	61.0	----	10.5	----	6.0	9.8	12.5	13.3	9.7
009	CH	PA	01	10	63	59	61.0	54.8	13.1	45.0	6.5	9.8	14.0	13.5	11.2
010	CH	PA	01	10	71	73	72.0	47.4	12.7	39.1	7.7	8.3	9.6	12.8	9.2
011	CH	PA	01	10	68	72	70.0	50.4	10.9	37.0	7.0	13.4	14.5	14.6	11.3
012	CH	PA	01	10	73	74	73.5	48.1	10.0	37.9	6.6	10.2	12.6	13.5	10.6
013	CH	PA	01	11	68	71	69.5	43.5	11.1	33.7	6.0	9.8	12.2	13.0	10.6
014	CH	PA	01	9	66	67	66.5	40.6	10.6	32.0	5.9	8.6	12.4	11.7	9.9
015	QE	PA	01	12	69	71	70.0	51.6	14.6	41.6	6.9	10.0	13.3	16.3	13.9
016	CH	PA	02	8	71	71	71.0	48.4	10.0	38.2	6.4	10.2	12.4	11.9	9.6
017	QE	PA	01	13	76	75	75.5	49.6	11.7	39.0	6.7	10.6	14.7	16.7	15.2
018	QE	PA	01	12	72	71	71.5	57.0	15.2	41.0	8.5	16.0	17.4	17.9	15.7
019	QE	PA	03	--	61	75	68.0	----	10.4	----	6.1	9.8	----	15.6	11.5
020	CH	PA	02	11	63	62	62.5	32.3	7.5	25.1	5.0	7.2	10.4	10.5	9.2
021	QE	PA	00	--	--	--	----	----	---	----	4.9	10.9	12.5	12.4	10.5
022	QE	PA	03	--	62	66	64.0	----	---	----	7.0	14.8	14.3	17.9	----
023	QE	PA	02	--	76	80	78.0	----	---	----	6.9	12.9	13.7	14.8	----
024	QE	DL	01	12	61	59	60.0	44.1	12.8	34.1	5.7	10.0	11.4	15.3	9.6
025	QE	DL	02	--	69	67	68.0	----	12.5	----	6.5	11.5	13.7	15.1	12.0
026	QE	SC	02	9	62	64	63.0	----	----	38.8	6.8	----	----	12.2	9.6
027	CH	SC	03	--	60	61	60.5	----	12.4	----	5.7	8.8	13.6	15.1	11.8
028	QE	MI	01	11	65	--	----	46.5	10.1	34.8	6.2	11.7	12.8	13.1	9.6
029	CH	BA	01	--	--	--	----	64.3	15.7	----	6.7	----	14.4	16.6	12.2
117	QE	PB	01	16	69	72	70.5	50.5	13.6	36.3	6.8	14.2	13.9	16.1	12.6
153	CH	WY	01	12	58	61	59.5	40.8	12.8	32.0	5.9	8.8	12.8	13.8	10.6
202	QE	RD	02	10	64	69	66.5	----	14.6	----	6.7	16.5	13.5	15.9	12.2
203	QE	RD	01	12	71	72	71.5	42.1	11.2	33.0	5.7	9.1	11.6	13.0	11.2
204	CH	RD	01	10	71	66	68.5	36.3	8.0	26.8	5.1	9.5	9.9	11.0	8.7
205	CH	RD	01	10	54	58	56.0	53.6	14.4	42.7	5.5	10.9	13.7	15.4	10.4
303	CH	PB	01	12	73	72	72.5	40.4	9.2	32.0	5.9	8.4	12.5	13.6	10.5
466	CH	PB	01	15	73	70	71.5	43.3	9.1	31.0	6.3	12.3	13.5	14.6	11.7
420	CH	PB	01	11	71	72	71.5	45.1	11.8	30.2	6.8	14.9	13.8	13.1	10.4
914	CH	PB	01	10	66	64	65.0	47.6	12.5	38.0	5.7	9.6	11.6	13.3	9.3

Table 2: Metric attributes of Pryor-Stemmed projectile points examined during this study. CATNO = catalog number; LT = material type; OR = source; PC = condition [00 = base only; 01 = complete; 02 = nearly complete; 03 = > 50% complete]; RA = radial angle; EAa = first edge angle; EAb = second edge angle; EA = edge angle average; ML = maximum length; BW = blade width; BL = blade length; BT = blade thickness;, HL = haft element length; HWP = haft element width proximal; HWD = haft element width distal; HE = see Figure 5. MATERIAL TYPES: CH = unspecified chert; QE = variable quartzite. SOURCES: PA = Sternberg collection; PB = Conner collection; RD = Red Desert collection; DL = Delozier collection; SC = Scoggin collection; MI = Miller collection; BA = Bass-Anderson site; WY = State of Wyoming collections.

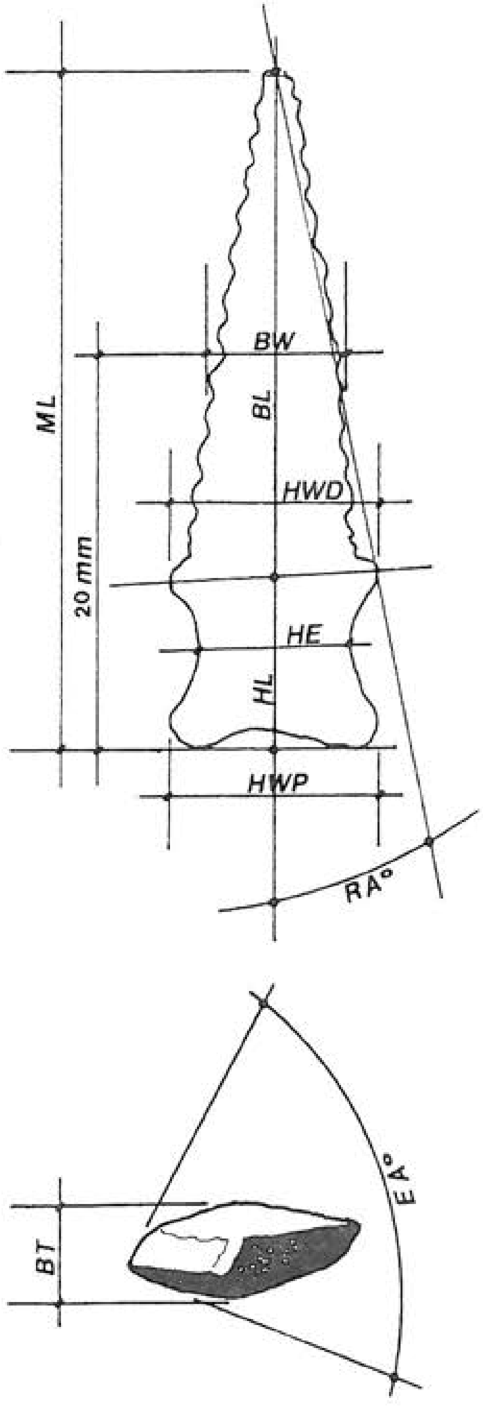


Figure 7: Landmarks used in measurements of Pryor-Stemmed tools.

RESULTS

Evaluation and accurate interpretation of stone tool edges can provide valuable information to archaeologists. Some investigators have attempted inferences about prehistoric behavior from tool edge angles salvaged from cultural assemblages (Knudson 1973; Reiss 1985; Sollberger 1970; Wilmsen 1970; Goodyear 1974).

In a comprehensive study of Dalton projectiles (a bi-beveled tool similar to Pryor-Stemmed) from an Arkansas site, Goodyear (1974) found a trimodal distribution of blade widths but little variation in haft element width. Edge angle was found to increase as blade width decreased from continued sharpening. Goodyear postulated varying functions for the three classes of Dalton tools. Morse (1971) suggested that the high edge angle in final stage points may have lent these types to some form of specialized scraping function.

Metric analyses of Pryor-Stemmed edge angles provide a bi-modal distribution for both the Pathfinder assemblage and the "all others" group (Figure 8). The mean EA for Pathfinder points was 68.59 degrees compared to 63.85 degrees for the other group. A standard error of .996 was found for the Pathfinder group and 1.538 for the second group. Alpha was set at .05 and the standard T test rejected the null hypothesis for intergroup relatedness. Equality of variance test resulted in an F score of 26.00 (with Alpha = .05, { Ho: $\theta 1 - \theta 2 < 0$}) and accepted the null hypothesis. The estimate of $\mu 1$-$\mu 2$ was 4.742 (>0).

Figure 9 shows the frequency and distribution of blade widths (BW) for the two study groups. Both show bi-modal distributions. The mean for the Pathfinder points was 11.41 mm with a standard error of .404 while that of the "all other" group was 12.45 mm and .715 respectively. With Alpha =.05 the null hypothesis (Ho: $\mu 1$-$\mu 2 \leq 0$) was accepted. The estimate of $\mu 1$-$\mu 2$ was -1.038 (<0).

A study of haft element measures

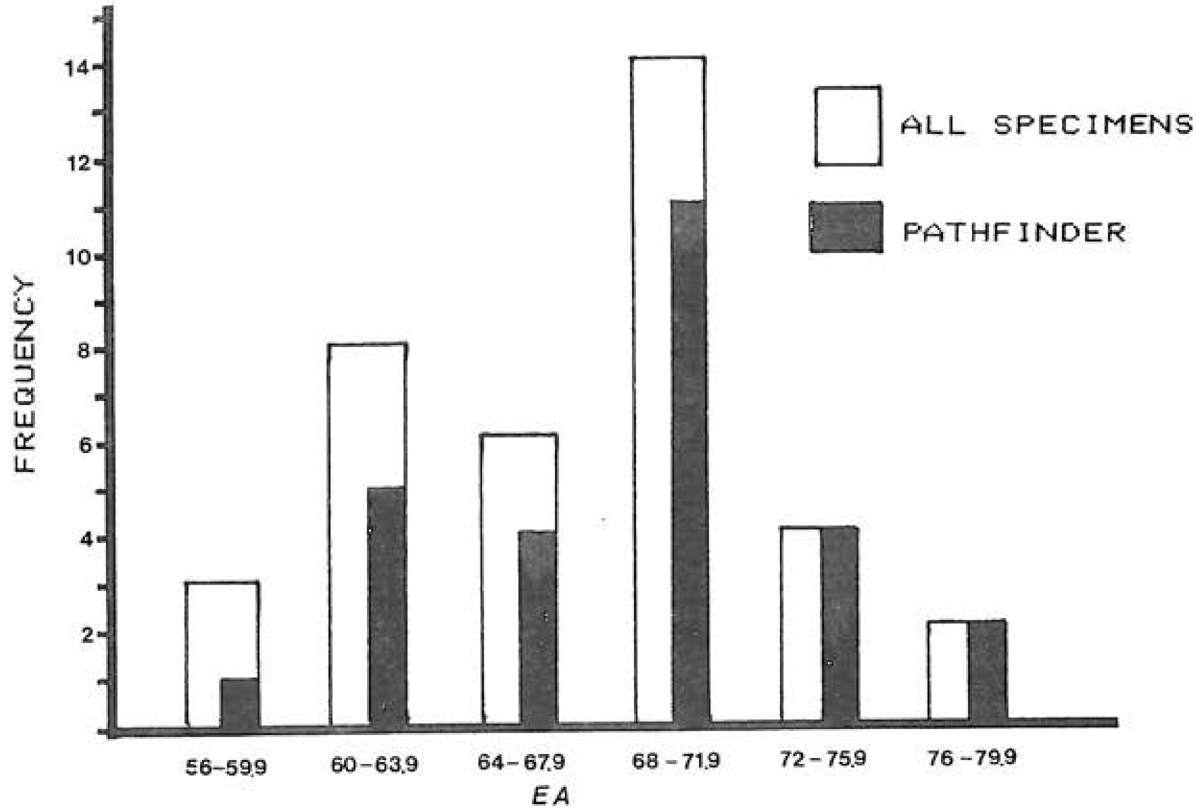


Figure 8: Modal clustering of edge angles of Pryor-Stemmed Tools (in degrees).

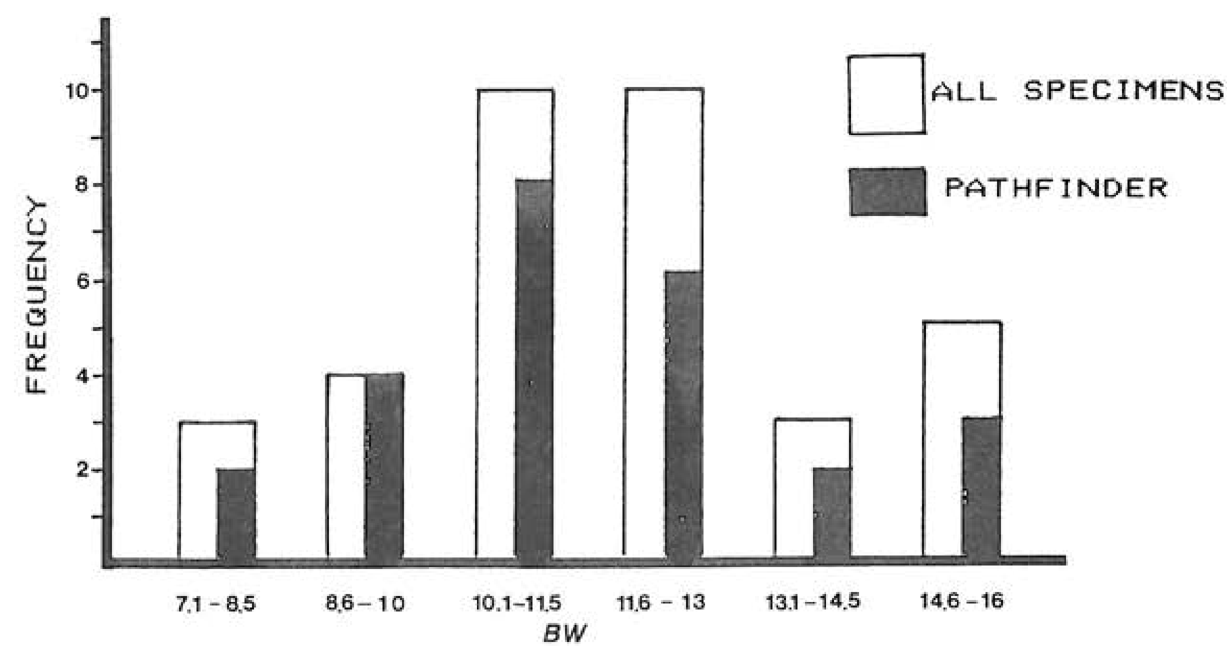


Figure 9: Modal clustering of blade widths of Pryor-Stemmed tools (in mm).

(Figure 10) indicates a bi-model distribution for Pathfinder points and trimodality for the "other" population. The mean for group 1 (Pathfinder) was 11.09 mm with a standard error of .336. For the "all other" category the mean was 10.71 with a standard error of .373. A standard T test showed the two groups to be homogeneous. The estimate of $\mu 1-\mu 2$ was -.377 with Alpha set at point .05 and (Ho: $\mu 1-\mu 2 < 0$). The normality assumption was found to be violated because of skewness (Figure 10).

Haft element sizes were compared with blade width measurements to evaluate extent of their correlation. This test involved only the Pathfinder group (n=25) with blade width = dependent variable (y) and haft element = independent variable (x), A linear relationship was shown but correlation was poor (R = .0329). The null hypothesis (Ho: $\theta \leq 0$) was rejected based on an estimate of $\theta = 1.014$.

When foreshaft taper and mainshaft socket metrics were juxtaposed to Pryor-Stemmed blade widths, no significant correlation was shown. This test involved only those tools from the Pathfinder collections.

DISCUSSION

Determination of use based on lithic wear patterns is beyond the scope of this paper. However, normally severe edge angles of Pryor-Stemmed tools tempts one to postulate specific tasks. Two modes are present in the Pathfinder collection (Figure 6). No statistical analysis was done to compare edge angle with blade width but visual observation of the points that comprise the mode 60-63.9 degrees (point numbers 006, 007, 008, 009, 019) show varied morphology, and little indication of any correlation. At least one author (Sollberger 1970) has attempted to resolve the bi-beveling question in terms of conservation of material. Sollberger suggested that this technique extended tool life over bifacial sharpening methods. There is no reason to suspect that any shortage of materials existed at the Pathfinder site since quartzite river cobbles are common and 61% of the points from this site are made of cherts. This may indicate that

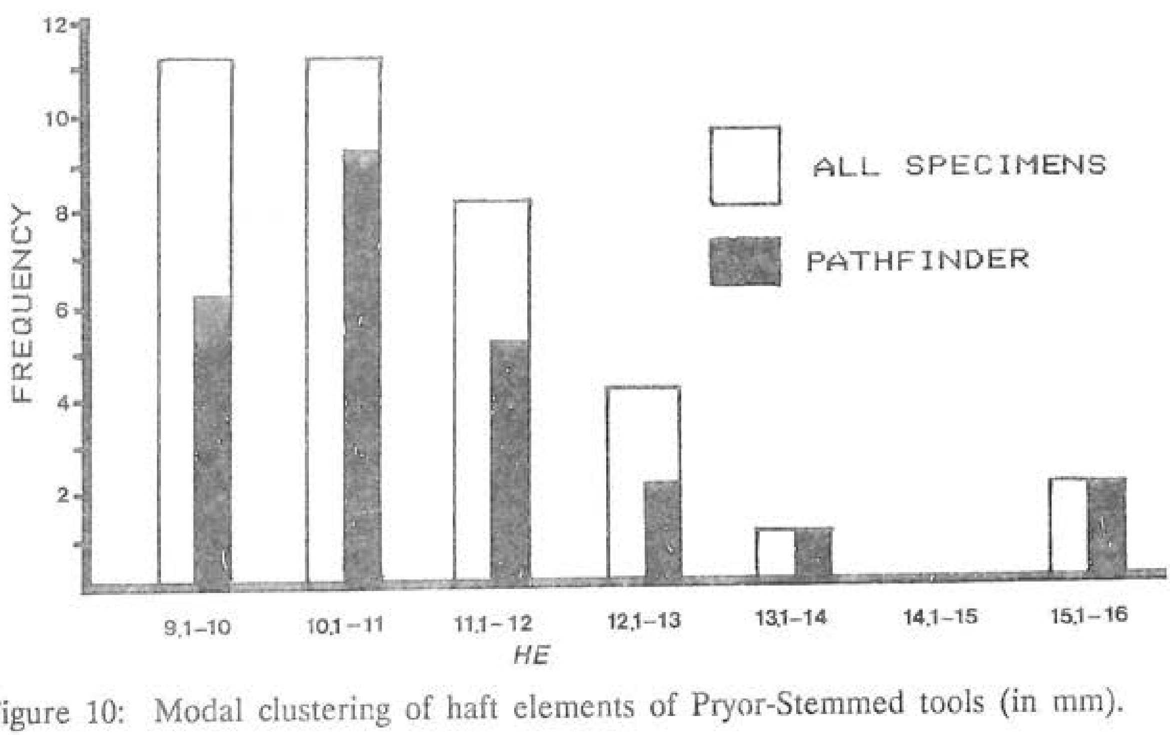


Figure 10: Modal clustering of haft elements of Pryor-Stemmed tools (in mm).

the users preferred to extend the life of those chert tools rather than make new ones of quartzite.

Wilmsen (1970) stated that tool edge angles will fall into three general categories with respect to function (l) 26 degrees to 35 degrees = cutting; (2) 36 degrees to 55 degrees = skinning, hide scraping, sinew and plant fiber shredding, heavy cutting of bone, wood or horn, and tool backing; (3) 56 degrees = bone working, heavy shredding and skin softening. All the Pryor- Stemmed points analyzed in the present study fall into Wilmsen's third category (Figure 8). That hypothesis is consistent with that of Morse (1971). Interestingly, Fawcett and Francis (1981:95) found that scraping tool edge angles fell between 55 degrees and 60 degrees.

Tool No. 005 (Table 2) demonstrates what must represent the final stages of use for Pryor-Stemmed. The hafting element is ground and does not appear to have been reworked. Strong distal haft element shouldering implies that the tool was continually resharpened while still hafted. Tools in this stage of attrition demonstrate the lack of serration so typical in the earlier stages, probably because serrations were difficult, if not impossible, to produce due to blade thickness along the axis. This limitation may have relegated the tool into another functional category. The generally uniform smoothness along the blade of tool No. 005 implies that the greatest portion of the blade edges was in contact with the material being modified. Through the processes of blade sharpening, the blade thickness (BT) has not been noticeably diminished.

Modal clustering may imply differing tasks for certain tools but one might make a similar assumption based on general morphology. For example, this writer could easily place tool No's. 003, 015, 017 and 117 into a class by themselves and suggest a specific use for them. Similarly tool No's. 004, 008, 011, 012, 016, 303, and 466 might be isolated and assigned another specific task, etc. Such classification schemes, however tempting, must, based on present data, remain extremely tenuous.

Variable hafting element morphology is the most noticeable characteristic of Pryor-Stemmed points (Table 2). Most exhibit grinding on the lateral margins and along the basal concavity. Some have little basal concavity (003), others have a parallel-sided stem (002), still others display ears reminiscent of Duncan (McKean) points. On tool No's 020 and 204, the hafting element has obviously been reworked. Varying haft element configurations may have been related to differing tasks and subsequently to different hafting mechanisms. On the other hand, they may simply have resulted from the individual maker's stylistic requirements.

Lack of correlation between Pathfinder tools and wooden foreshaft tapers and mainshaft sockets may have resulted because:

a. Later period foreshafts and mainshafts were of a different size than those that might have been used on Pryor-Stemmed points.

b. Pryor-Stemmed tools were not used to bore sockets in mainshafts.

CONCLUSIONS

Statistical analysis of metric data does not confirm homogeneity between Pryor-Stemmed tools of the Pathfinder assemblage and those categorized herein as "all others." This may be explained by the technical variability that is inherent in most projectile point types. It may also result from geographical variation or individual stylistic preference. Perhaps because of this inherent variability, statistical analysis is not a viable tool in the evaluation of projectile point assemblages.

Assignment of the tools to functional classes based on metric modality must be contingent upon relating that modality to task specificity, which has been documented by use-wear analysis. Most importantly, use experiments should be conducted using replicated tools in varying stages of attrition and applied to a variety of materials.

ACKNOWLEDGEMENTS

The use of artifact material from the private collections of Bill Sternberg, Jack Conner, Dr. Bill Scoggin, Harold Delozier and the Miller collection is very much appreciated. Access to publicly owned artifacts was provided by Drs. Mark Miller and George Frison. I would also like to thank George Zeimens for permission to study the Bass-Andersona Cave specimens. Dr. Mark Miller read the text and made valuable suggestions. Dr. Danny Walker provided photographic expertise. To all I am grateful.

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DURABLE PALEOINDIAN ARTIFACTS: XRF VARIABILITY OF SELECTED WYOMING SOURCE MATERIALS

by
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ABSTRACT

The various needs and wants of Paleoindian economic systems required several raw materials. Interesting information on the lives of Paleoindians can be inferred by knowing the sources of the items that they used. One can realize complexities in their lives to obtain the materials that they used. To obtain materials from distant sources implies mobility. Either a group, or an individual, would go to the source, or the group had trade and exchange in a long distance network. Such studies are limited to a few durable artifacts and must realize that this was only a part of their total lives. It may, in fact, represent a distortion. The present work is intended as a survey of measurable information available in terms of the variation of source materials. The selection of only some source material was necessary because this is an ongoing project. The present report is a progress report.

INTRODUCTION

It is interesting that something can be said about behavior by studying the few durable artifacts left behind by Paleoindians. Dating techniques tell when behavior happened, whereas element characterization leads to artifact source area identifications and can tell where behavior happened.

The quality of the statements of behavior is more likely to be reasonable if they are based on accurate measurements of the artifacts. The X-ray fluorescence technique, XRF, used here allows for a precise determination of the amounts of various elements. The procedure is non-destructive. The detector efficiency has been studied and data could be converted to ppm (parts per million) when necessary. This present technique normalizes to the Compton scattering and is preferred because it is non-destructive.

Several trace elements are used to give a unique "fingerprint" or "signature" for each source. If only one element was used, then two sources might be identified as the same. By using several elements the probability of the signature being the same is not likely. The two element ratio of Na/Mn (sodium/manganese) has been used in the past (Griffin et al. 1969). The use of three elements is common in chemistry and geology (Atkins 1985; Masing 1944). Nine elements are presently analyzed, with five reliable trace elements used in the characterization.

The unique identification of each source allows artifacts to be assigned to a source with a high probability of being correct. The strength of the method is being able to attach the identification of the source to an artifact no matter how far apart the two occur.

Possible Explanations of Material Transportation

There are two common models of explanation for how a durable artifact material might have been transported to the location where it was found. One explanation is the mobility model that the material was acquired during the yearly migrating of the band (Jackson 1988). A slight variation is that a part of the band was adequately mobile so that the whole group did not move to the source. For example, two capable hunters might be assigned to go to the source and return with some material, possibly partially fabricated toward useful items. The common resources are more likely to be on a route the whole band might follow. Exotic resources might more likely be distant with only a few members doing the procurement.

A second explanation is the trade/exchange model. One variation is that where the material is transported great distances by trader specialists. Another variation is that the material is transported shorter distances by the territorial occupants and passed on to occupants in the next territory. An appropriate useful amount is removed by the locals as the material passes through the territory (Baugh and Terrell 1982; Baugh and Nelson 1988).

A necessary realization is that even after long transport the material was probably made into useful items. These can be further transported, traded, lost, and reused before being finally "lost" and going into the archaeological "record" (Raymond 1985).

Trade/Exchange Examples

A sampling of the obsidian sources used for both the Yellowstone Lake region and for sites outside Yellowstone National Park is available (Wright and Chaya 1985). For the archaeological sites in the Yellowstone Lake region (Chittenden Bridge 48YE516, Fishing Bridge 48YE1), 98.8% of the sources of samples are Obsidian Cliff. Since a quality source of material is readily available, it is reasonable that it be used. For sites outside Yellowstone National Park (Hopewell, eastern Wyoming), 83.8% of the sources of samples are Obsidian Cliff. The good quality Obsidian Cliff source of material is still surprisingly predominant considering the great distance and the chance to be diluted by other sources. This predominance implies a possible developed trading mechanism. One needs adequate data to distinguish between a system with a class or group of traders, and a procedure of trading with the neighbors on the boundaries of ones territory. Both methods could move quality material available in large amounts for large distances, and both methods would lead to a reduced amount being at greater distances. The trader group method would have the possibility of no material for a distance and then material reappearing in quantity. A useful parameter to keep track of would be the amount of exotic obsidian compared to the other lithic materials. If, at a great distance, obsidian suddenly appeared in great quantity, one might expect it to have been specifically brought there by traders.

RAW MATERIALS USED FOR DURABLE ARTIFACTS

Plant and animal materials provide good information of Paleoindian behaviors but these decay and are lost more easily than mineral materials. Useful artifacts require the ability to remain preserved over thousands of years. The selected artifact materials discussed here are durable ones that became available during this study. The selected analysis measurements are a set of trace elements of relatively high energy. These are the most convenient from a technical points of view. These elements, rubidium, strontium, yttrium, zirconium, and niobium, occur in the fifth period of the periodic table. The low energy related elements of the fourth period, potassium through nickel, are also of use in the present studies.

Obsidian

A mineral material that has easily identified elements is obsidian (Bowman et al 1973a; Anderson et al. 1986; Hughes and Nelson 1987; Wright and Chaya 1985; Wright et al. 1990). It is also an easily fabricated material for tools and points, so was much used. It has been extensively used in source identification studies so that many sources have been located (Nelson et al. 1975; Mendoza and Jester 1978; Godfrey-Smith and Haywood 1984). It is usually easy to separate obsidian in an assembly of artifacts.

The relevant parts of the Fish Creek/Teton Pass and Obsidian Cliff spectra are shown (Figure 1). Averages and standard deviations of intensities of the five trace elements from the data analysis were calculated (Table 1). The variation in the composition is represented by the standard deviation for the twelve samples for each source. For most elements, the one standard deviation variation is about 5% whenever there are about twelve samples in the source set. A plot of the three elements (rubidium, strontium, and zirconium) is shown (Figure 2) for several sources from Wyoming and nearby states.

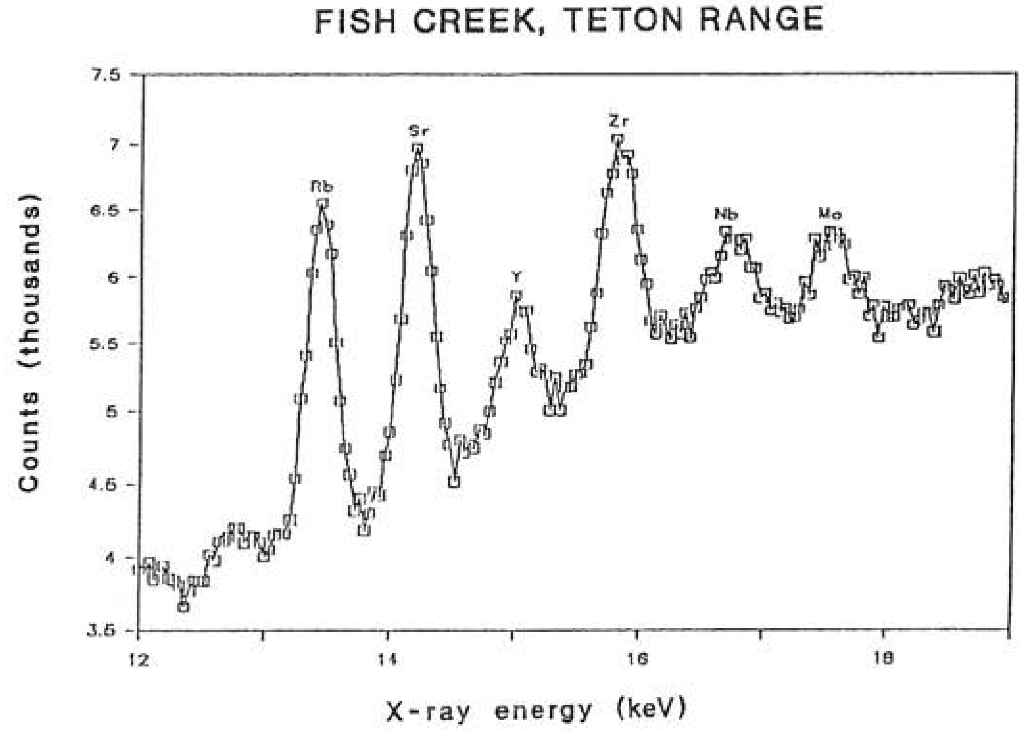
Ochre

Red ochre is a material that generally has the easily identified higher energy elements as for obsidian. The artifact materials are presumably made by grinding hematite ore. The element's composition can be changed by addition of foreign materials, as when making a paint of ground material by adding water, grease, or oil. The ratio of the amounts of the usual elements could remain the same. However, the intensity of the normalization peak changes with addition of foreign material not in the hematite.

The few ochre sources that have

	LOCALITY	TRACE ELEMENTS				
		Rb	Sr	Y	Zr	Nb
FC	Fish Creek, WY, near Wilson	620	668	248	559	256
		30	29	16	23	17
FS	Fish Creek, WY, second var	587	923	246	877	270
		36	43	12	15	13
TP	Teton Pass, WY, south of pass	606	663	246	554	252
		24	24	16	25	19
YC	Yellowstone National Park, WY	1273	2	687	964	478
	Obsidian Cliff	77	7	46	47	25
TA	Targhee National Forest ID,	908	221	411	1821	501
	Bear Gulch	58	34	31	79	30
WC	Wright Creek, ID, near Malad	678	395	331	574	317
		31	33	33	37	32
GL	Grassy Lake, WY,	991	0	596	1381	562
	east end of lake	111	5	5	158	62
CP	Connat Pass, WY	908	98	579	1089	546
		72	41	36	48	39

Table 1: Relevant data analysis summary of obsidian sources with description of location and trace element composition. Average trace element composition on first line for each source is normalized to Compton scattering. Second line is measurement error of sample average.



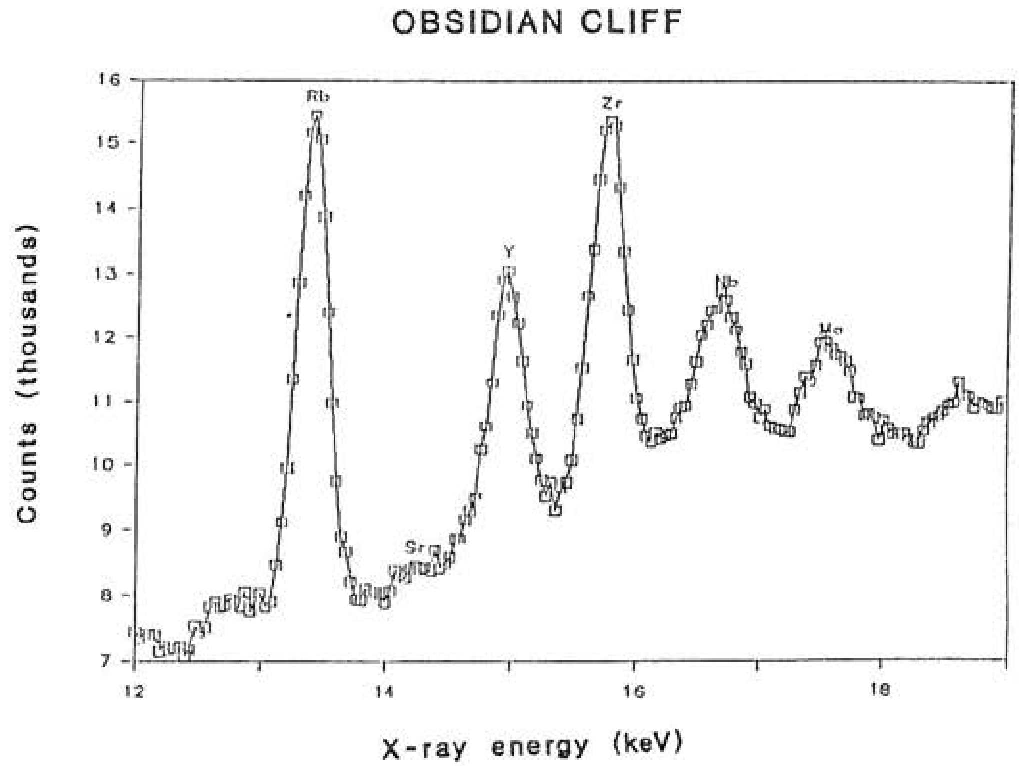


Figure 1: XRF spectrum for trace element region of interest. The two sources are obsidian and ignimbrite materials from Obsidian Cliff and Teton Pass.

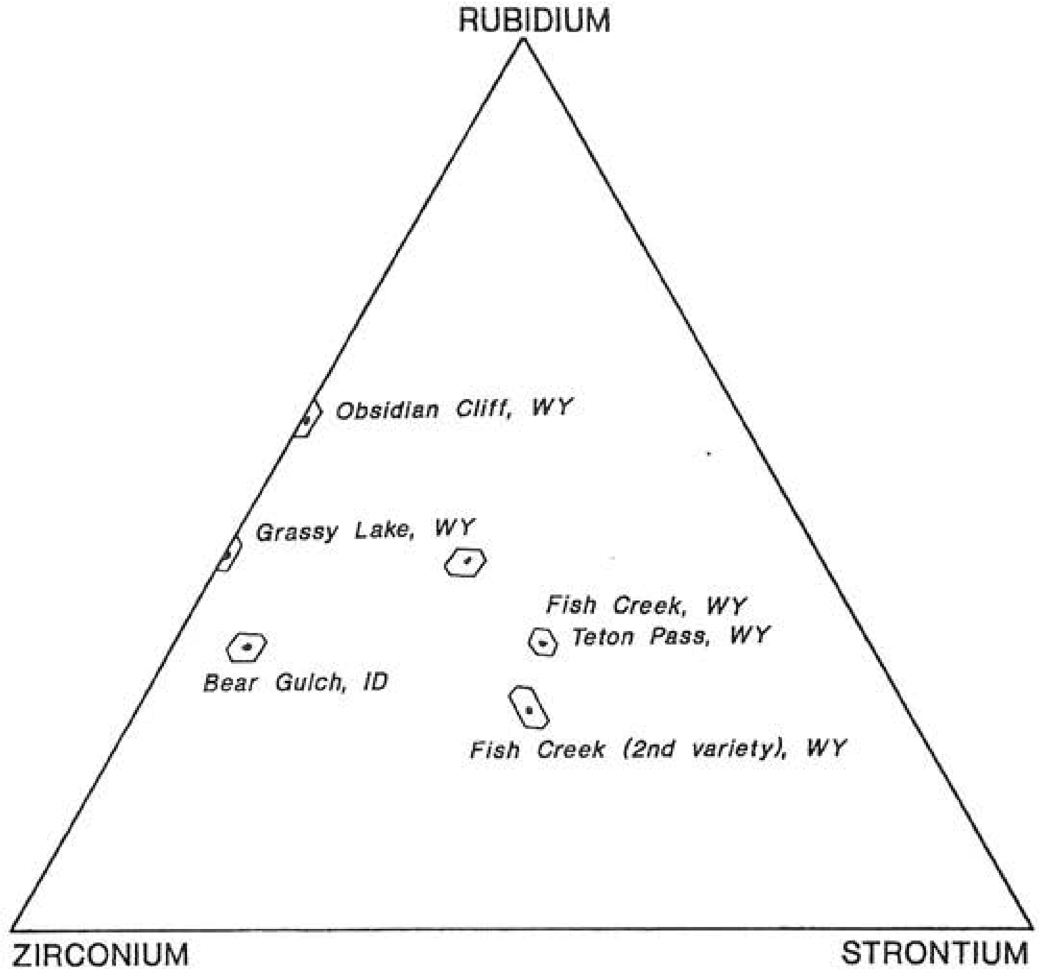


Figure 2: Ternary plot of fractions of rubidium, strontium and zirconium for several obsidian sources with associated error bars for one standard deviation.

been studied are the Sunlight Mine, WY, Rawlins Mine, WY, a southern Montana Mine, and two others for comparison from Bolivia and Ontario. The way to use the data would be to form ratios of the fractions of rubidium, strontium, and zirconium. A sample of ochre from the City Springs burial near Laramie contains titanium, which the Montana source has and the Sunrise and Rawlins sources do not. However, the composition for this sample for the five usual trace elements is further from the Montana source and closer to the Rawlins and Sunrise, therefore ochre is not consistent. Ochre attached to several Paleoindian points from the prehistoric quarry site at Sunrise Mine does not match with the source material from that quarry. The experiments have thus shown the material has a large natural variation. This is probably due to the erosional method that produces the deposit. For example, the Sunrise Mine is made of eroded zinc sulfide (ZnS). Various amounts of the elements could easily have been mixed into the final hematite deposit (Jim Miller, personal communication, 1990). Any possible method using the data must allow for the large variation. It may be necessary to consider that certain elements are simply present or not present. The experiments with this material must be understood to progress in several other studies. Reanalysis of the data for other lower Z elements on the periodic table is being considered.

Steatite

The higher energy useful X rays of elements of obsidian and ochre are not adequately available for analyses of steatite, quartz, and chert. However, there are several lower energy X rays from other elements, such as the elements from potassium to nickel. The effect of attenuation by the path length of air is a great effect at low energies. A concern is to be careful about repetition of the sample positioning when it is put into the counting apparatus.

Further analyses are in progress, as well as plans to collect sets of samples from other source quarries to learn of the allowable variations. Some source quarry descriptions are available in the literature (Frison 1982). In other destructive studies, the difficulties with the element composition have been overcome using rare earth elements and normalization to meteor compositions (Allen et al. 1984). The present method shows promise and will be pursued (Adams and Kunselman 1990).

Quartz

The reason for inclusion of quartz is its appearance in Paleoindian caches and artifact collections. The material was studied in the usual manner, including several pieces removed from the same quartz crystal. A reliable fingerprint could not be obtained. The explanation may be related to quartz crystals being formed over a long enough period that the trace element composition of the water was not constant.

It is not necessarily anticipated that locating quartz sources would be feasible. The source of a Paleoindian artifact may have been a crystal growing in a cave. When the crystal was removed, little evidence would remain and the cave might collapse over time. The ultimate use of the XRF method may be to compare two artifacts to know if they were from the same or different sources.

Chert

A durable material that is available almost everywhere is forms of chert. Chert is potentially useful for transportation information, both locally and long distance. This usefulness has been realized and investigated for many cherts (Luedtke 1978; Kunselman et al. 1989). The success in measuring variations that allow distinguishing cherts has not been successful. The geological processes in forming a chert source are not unique and have varied through time. This probably leads to variations within the one source that has been measured. Because of the expected usefulness of this material in many studies, there are plans to extend the set of elements used since no success has been met with the usual trace elements. Data are available for further study, using ideas presently being tested with the ochre and steatite reanalyses. A similar conclusion of being unable to do source identification was reached by Luedtke (1978).

SOURCE IDENTIFICATION

The techniques of X-ray fluorescence are well known and are described in several references (see Goulding and Jaklevic 1973). A description of the apparatus used in the present studies has been presented previously in the Knife River Flint studies (Kunselman et al. 1989). Only essential features are presented now.

The Compton X-ray scattering from all the electrons of the total material was used as a normalization peak. The L series X rays of tungsten were used for excitation. The use of these five trace elements (rubidium, strontium, yttrium, zirconium, niobium) is felt to be dependable. The energy is adequately high enough to be on a smooth portion of the detector efficiency curve. The K_β trace element X rays appear almost exactly under the K_α X rays for a Z greater by 2, so that the signal is not "washed out" by noise.

The element composition that is determined using the X-ray fluorescence technique is normalized to the Compton scattering peak. This is so the variation is not dependent upon sample shape, size, position, nor the time of counting. The consistency of the measuring procedure has been extensively tested. The best tests have been with geologic samples obtained from the University of Wyoming Geology Department that were used to calibrate the apparatus to determine the element concentration in ppm (parts per million). Some of these samples were a powder, while others were the same material but rock. The agreement has been adequate in comparing to published values of ppm in samples from the same sources. A comparison is shown (Table 2) for Bear Gulch, Targhee National Forest, and Obsidian Cliff samples. The samples are independent of that used by the other two measurements, but it is presumed all are from the source location stated.

The reason for not converting to ppm is that any mathematical manipulation propagates an additional uncertainty into the numbers. The apparatus has a non-linear efficiency dependence, which makes it less certain to determine reliably. If the stated interest was in analytical chemistry, then of course ppm would be of interest. Archaeologists are interested, in the long term, in behavior questions dealing with anthropology. A reliable technique to source artifacts by comparing the element content between sources and artifacts is needed. Also, the samples available as artifacts are sometimes small quantities, as in flakes from screen washing. For these materials, the normalization procedure is not direct and would depend upon an undependable calculation. The small thin samples require the ratio of at least three nearby elements for identification purposes. Experimental flakes made from known nodules were used in con-

	Rb	Sr	Y	Zr	Nb
Bear Gulch Source					
WDXRF(3)[a]	171.1(3.7)	43.7(2.6)	50.2(1.9)	316.2(4.0)	49.9(1.1)
EDXRF(10)[a]	172.2(5.8)	44.7(2.1)	40.0(1.1)	293.6(10.4)	55.8(4.0)
EDXRF(3)[b]	163.3(5.9)	55.2(2.9)		283.6(2.4)	
EDXRF(12)[c]	166.2(14.9)	38.7(6.3)	35.2(3.4)	282.8(21.6)	68.6(5.9)
Obsidian Cliff Source					
WDXRF(8)[a]	243.0(5)	4.9(2.1)	88.0(7.6)	210.5(7.1)	46.2(4.1)
EDXRF(3)[b]	251.9(4.1)	10.4(2.0)		185.2(11.6)	
EDXRF(12)[c]	233.0(20.3)	0.3(1.2)	67.8(6.2)	153.3(12.2)	58.7(4.8)

[a]Hughes and Nelson 1987:314
[b]Anderson et al. 1986:844
[c]Present work, UW-XRFG.

Table 2: Comparison of three analyses (in ppm) of obsidian sources from Bear Gulch, WY, Targhee National Forest, ID, and Obsidian Cliff, Yellowstone National Park, WY. The standard deviations are listed in parentheses in ppm.

firming the procedure for thin flakes.

SOURCES OF SELECTED PALEOINDIAN ARTIFACTS

Dating of Artifacts

The first question is, how one knows that an artifact in question is of Paleoindian age. There are several methods including radioactivity, obsidian hydration, stratigraphy, or style. Non-destructive techniques would be desirable and, for obsidian, there may be a way. An attempt is being made to develop a technique to measure the hydration rind that is normally measured destructively (Friedman and Long 1976). A red laser (University of Wyoming Physics Department) and oils of various indices of refraction (Denver USGS) have been used. Neither a directly reflected signal nor an interference signal were found. The thoughts for further study are to attempt a measurement of rotation of circular polarization in the hydrated surface layer. The extensive set of calibrated sources measured using a destructive method by Irving Friedman from the USGS would be used to test any non-destructive technique.

Jackson Lake Lawrence Collection

A selection of obsidian points from the Lawrence collection from north Jackson Lake were examined (see Peterson, this volume). These are of interest in that, for comparison purposes, they contain styles that range from Paleoindian, to Archaic, and to Late Prehistoric. Of the 38 items in the collection, fifteen are probably late Paleoindian, 22 are probably Plains Archaic, and one is Late Prehistoric (see Peterson, this issue). Eighteen have a source locality at Teton Pass or Fish Creek (TP/FC), nine are from Yellowstone, Obsidian Cliff, five are from Targhee National Forest, Bear Gulch, four are from the Fish Creek second variety, and one each from Grassy Lake, and Connat Pass. All are from sources within 60 miles of the Jackson Lake region. The points from each probable source are presented (Tables 3, 4), and the appropriate sources are identified (see also Peterson, this volume). It is interesting that the Paleoindian points represent the furthest sources, when compared to the Archaic. A possible speculation on this idea with even this small amount of data might be that it represents a greater mobility for the Paleoindian culture.

Fenn Collection

The eight Paleoindian items made of obsidian from the Fenn Cache (George. C. Frison, unpublished data) were subjected to the XRF technique. The signal was the same for all eight items, and

LOCALITY	SPECIMEN NUMBER
Teton Pass/Fish Creek	LS-210,-214,-231,-612,-230,-213,-221,-207,-227,-232, -95,-87,-105,-205; TL-46,-6,-16,-42
Obsidian Cliff, YNP	LS-223,-229,-233,-208,-112; TL-45,-44,-43,-18
Bear Gulch, TNF	LS-226,-72,-80,-106,-103
Fish Creek 2nd variety	LS-203,-85,-68,-102
Grassy Lake	unlabeled Late Plains Archaic
Connat Pass	LS-238

Table 3: Probable locality sources of Lawrence Collection projectile points from north Jackson Lake. Points from each source are listed by specimen numbers.

matched the signal from source material of Wright Creek, near Malad, Idaho. The cache is probably from southwest Wyoming so that Wright Creek is not a great distance.

Steatite

Presently, no steatite objects of Paleoindian age are known. It is possible that steatite used for beads or effigies will ultimately be found in Paleoindian context. To test the method, a steatite vessel was studied along with available source material. The vessel did not exactly match any presently known source. The match to the South Bighorns source was adequate for most of the elements. To know the range of variation of the elements, one needs to study additional source areas.

Ochre

A few ochre source samples were available so that it seemed desirable to test the method on red ochre artifacts. A burial pouch of red ochre from the Laramie City Spring was studied. The material is a hard lump that could have been powdered and then possibly mixed with a binder that became hard over time. It presently has several parts glued together so that the glue must be avoided in the X-ray analysis. No source material with the present analysis closely matched the artifact. A conclusion based on the presence or absence of certain elements was that it could not be from the Rawlins or Sunrise Mine sources. The southern Montana source was possible but not definite.

An experimental archaeology test was conducted using eight Paleoindian points that were from the Sunrise prehistoric mine source. They were probably used to scratch the hematite material in the mining of the red ochre, or they could have been part of a cache. They are all broken and are not of a large burial or raw material cache size so that the mining tool hypothesis seems more reasonable. The set of points selected were those that had significant amounts of red ochre fused onto the artifact. The assumption was made that the red ochre was from the immediately available Sunrise source. The variation of the element signatures for this material was again not adequately small as for obsidian. This served as a definitive test using that at present there is not a reliable handle on chemical characterization of red ochre with the present XRF technique.

CONCLUSIONS AND FUTURE DIRECTIONS

Appropriate comments have been included in various sections so this will be a summary. Clearly the variations of obsidian sources are adequately small so that reliable statements on connections between artifacts and sources can be made. The geologic reason for this fact has to do with the formation from uni-

	YC	TA	GL	CP	FS	TP/FC	Total
Late Paleoindian	1	4			3	5	13
Early Archaic	4	1		1	1	10	17
Middle Archaic	3					1	4
Late Archaic	1		1			1	3
Late Prehistoric						1	1
Total	9	5	1	1	4	18	38

Table 4: Summary of obsidian sources for Lawrence Collection. YC = Obsidian Cliff, Yellowstone; TA = Bear Gulch, Targhee National Forest, ID; GL = Grassy Lake, WY; CP = Connat Pass, WY; FS = Fish Creek second variety, Wilson, WY; TP = Teton Pass, WY; FC = Fish Creek, Wilson, WY.

form magma pools (Bowman et al. 1973b).

The attempts at statistically proving that an artifact had a probable source was not successful for all the durable materials. The variations in red ochre and chert depend upon the source in question. The sources of these materials have no characteristic elements with reasonably small variations. The hematite source for the Sunrise Mine is postulated to be a Precambrian pyrite deposit, and the sources for cherts can be various aqueous solutions. Both formations were produced over a long time so that various other minerals had opportunities to accumulate. A similar difficulty occurred with quartz. The steatite seems to possess a workable signature in terms of consistency. The only difficulty is a technical one to do with the ease of selecting and analyzing the choice of elements, which are all crowded into the low energy end of the spectrum.

The future direction will include continuation of the things that work, such as the obsidian and steatite source identification. The value of chert identification is desirable and the low energy element analysis is being continued and extended. The low energy elements will also be analyzed in the red ochre data. Further experiments with the source and Paleoindian points samples from the Sunrise Mine are being considered. It seems reasonable that a definitive procedure can be established. It is expected that an understanding on how to control the ochre variation will result in a step forward for the other materials.

A key feature for the future studies is that all the data acquired has been stored on magnetic media. We will of course acquire further data as new questions are developed that cannot be answered by the present data.

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ROCKY MOUNTAIN REGION STOCKRAISING ARCHAEOLOGY: AN EXAMPLE FROM NORTHCENTRAL WYOMING

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ABSTRACT

Rural economy of the North American, semiarid west has been dominated by stockraising since the beginning of Euroamerican expansion into this area in the late 1800s. The rural archaeological record of the historic period in this region is largely a reflection of these economic processes. Yet the nature of stockraising archaeology is poorly understood and largely absent from the literature. This study is a first step in understanding the nature of the rural archaeological record and its meaning in this region.

INTRODUCTION

Stockraising has dominated Wyoming's Euroamerican economy since its large scale expansion into the state after the "agreement" of 1876 ceding the Black Hills and the land to the west to the United States (Larson 1965:105). Although other industries, notably coal and oil, have been, and continue to be, major sources of income, they are highly influenced by fluctuations in world economy. It is stockraising that has been the steady backbone of Wyoming's economy (Brown 1980). That is, while some mineral production has boomed and completely collapsed, profits from stockraising continue at a more steady pace. Thus, if world markets for stock are depressed, Wyoming stock production will decrease, but it will not decrease to the degree of coal or oil production. These latter economies require a greater effort and capital to continue production.

It is odd that archeology of an important industry in Wyoming's history, an industry that could keep Wyoming self-sufficient indefinitely, remains largely in a state of mythology. Archaeologists are frequently heard saying (if they discuss stockraising archeology at all) "oh that's just a sheep camp" or "that's just a ranch," as if every sheep camp and ranch were the same; as if everybody knew just what such sites were; and as if the variation among such sites carried no further meaning. Indeed, if a site is "just a sheep camp" and not demonstrably over 50 years old, it is not necessarily recorded during usual salvage projects (Tim Nowak, personal communication, 1990), while some stock related sites are not eligible to receive a state site number (in 1986, Wyoming SHPO refused to give the senior author a site number for a Euroamerican fence of undemonstrated age). Yet the importance of investigating recent, even currently occupied, stockraising sites has been shown (Teague and Anderson 1983).

What are the characteristics and nature of variation among stockraising sites? To begin answering this question the senior author has earlier presented an idealized stockraising settlement system model for the Rocky Mountain region (Kornfeld 1982, 1983). For the two main components of stockraising, cattle and sheep ranching, the model identified seven site types. These are ranch headquarters, line shacks (camps), watering and other facilities (salt licks, etc.), drive camps, central sheep camps, sheepherder camps, and stock control sites (shipping/docking/shearing). In the present paper, we largely deal only with the archaeological record of these sites. We also describe some characteristics as well as variability of these site types from a regional sample. We argue that only with questions of interest and knowledge of the archaeological record (its characteristic and variability) can stockraising archeology contribute to the understanding of Euroamerican cultural process in Wyoming and the Rocky Mountain Region. The present study is a step toward describing variability in the archaeological record of stockraising in this region.

THE SAMPLE

An excellent sample from which to begin describing the characteristics and variability among stockraising sites is found in the records of the Western Powder River Basin (WPRB) archaeological survey (Reher 1979). This is a useful sample, because the survey covered a large area in which much of the range of stockraising settlement variability can be found. The Western Powder River Basin archaeological survey (Reher 1979) covered Johnson and Sheridan Counties of Wyoming (Figure 1). The two adjoining counties stretch approximately 200 kilometers north to south, and 100 kilometers east to west, the long direction roughly paralleling the western forks of the Powder River. The project area covered approximately the western half of the high basin (Powder River Basin, 3,500 to 5,000 feet ASL), the foothills of the Big Horn Mountains (4,000 to 8,000 feet ASL), and the mountains themselves up to the divide (above 7,000 feet ASL).

This region was surveyed in transects designed to cut across the major environmental zones of the Powder River Basin. However, the survey was largely restricted to Bureau of Land Management land. Some zones, notably floodplain areas, are underrepresented as they tend to be privately owned (Reher 1979:154). For more details of the sampling design, see the Western Powder River Basin Survey report (Reher 1979).

Thirty-eight sites recorded during this survey were judged to be a part of the stockraising settlement system and thus are the sample of sites discussed here. The artifact assemblages and facilities at these sites are discussed below followed by a description of a sample of the sites of each functional type. Finally, the entire WPRB stockraising site sample is pigeonholed into functional stockraising types as defined earlier (Kornfeld 1982, 1983).

THE ARTIFACTS

Items recorded at the stockraising sites in the WPRB consist mainly of Euroamerican items. However, aboriginal items were also often found. The distribution of aboriginal items at some stockraising sites suggests that they were collected by the Euroamerican occupants and lost or discarded. On the other hand, aboriginal item distribution at other sites suggests the presence an earlier aboriginal component.

Over 340 Euroamerican artifacts were recorded on the 38 sites in this sample (Table 1). These are grouped into 15 artifact classes. This typology is designed to be similar, and thus comparable, to that used by South in the southeastern United States (see South 1977; South and Widmer 1977; Erickson 1979). By using a comparable typology, the artifact pattern representing the Rocky Mountain stockraising settlement system can be constructed. Quantitative data for items at some sites is presented (Table 1). At other sites, only presence/absence information (based on field notes) is available. Regardless, the figures give the reader an appreciation of the artifact content of stockraising sites.

Although not a goal of this study, the data also show the Rocky Mountain stockraising artifact pattern (Table 1). The Kitchen and Food artifact group comprises the largest category (64.1%), followed by the Tobacco artifact group (17.9%), followed by other categories with minor proportions of items. Caution should be exercised in using these figures as the Kitchen and Food group is probably underrepresented. That is, if actual counts replaced the presence/absence information, a higher frequency of this group would likely

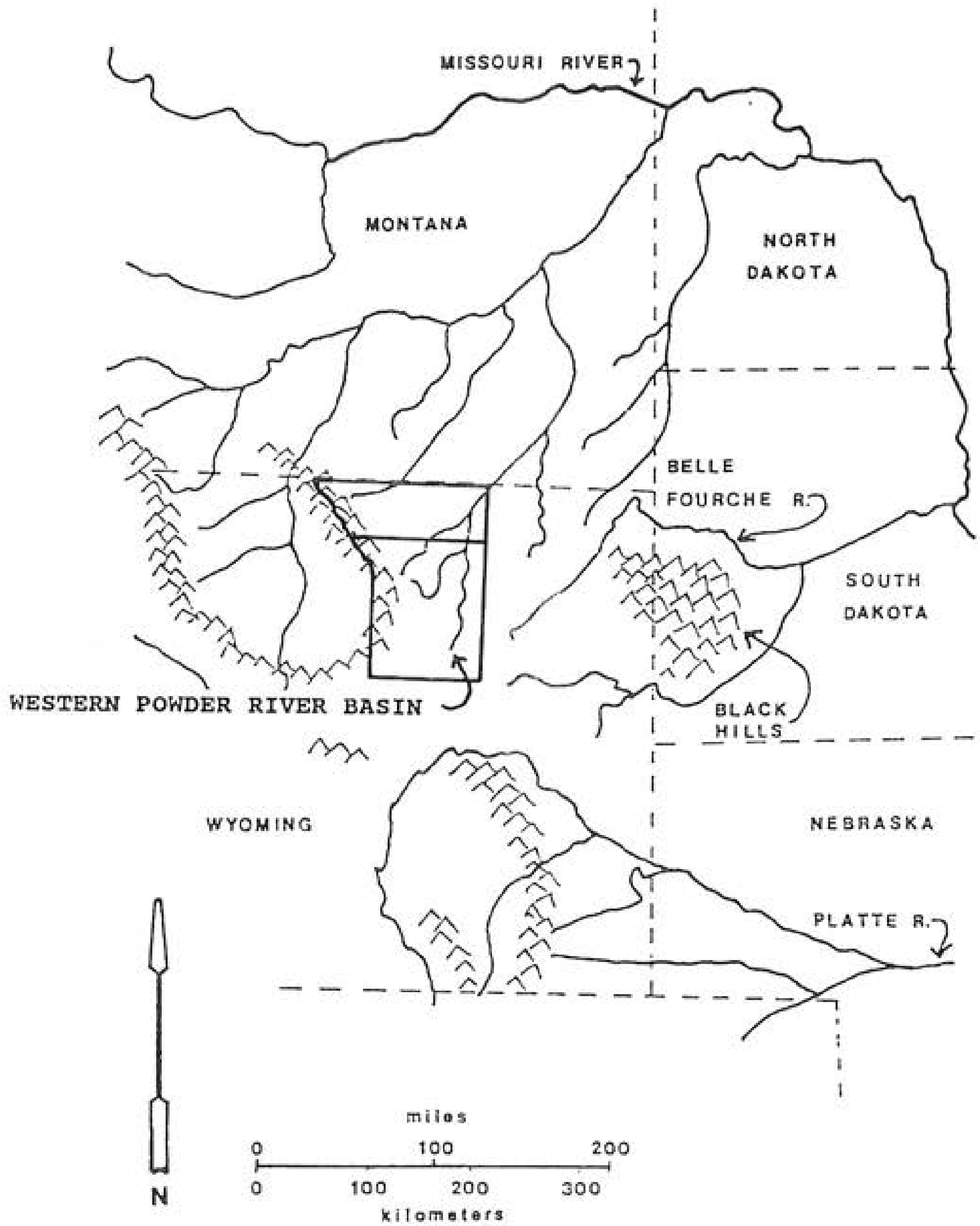

Figure 1: Location of the Western Powder River Basin site sample (Johnson and Sheridan counties, Wyoming) discussed in text.

emerge. Erickson (1979) found slightly different artifact patterning in the Red Desert with 87% of the artifacts belonging to the Kitchen artifact group followed by the Tobacco group. Investigation of the variability in artifact patterns between regions is beyond the scope of this research. It must be stressed however that this variability is suggested as a necessary step in the understanding of Euroamerican stock-raising processes.

The focus of the present study is on intrasite and intersite variability. As such, the importance of the artifacts lies in the characteristics of their inter- and intra-site distributions. It is expected that the length of occupation, number of

Site	#	Kitchen & Food: Glass	Kitchen & Food: Cans	Kitchen & Food: Utensil	Kitchen & Food: Other	Furnishings: Appliance	Furnishings: Bedroom	Furnishings: Other	Activity: Tool	Activity: Leather	Activity: Other	Arms	Clothing	Fauna	Tobacco	Other	TOTAL
48JO	412		1			1	1										3
	437	+		1		1										3	5
	460		22		+									1			23
	481					1											1
	495		+			+				+							
	498		+												2	1	3
48SH	165	+				3	1									2+	6
	225																
48JO	392	2	18	1			1						1	5	3	+	31
	394	+	+						+		+						
	435		+									2		2			4
	438	+															
	444	1	15												14	1	31
	457	2	1								1		1		9	+	14
	461		21	2					1		1	6	2		7	2	42
	462			1											3		4
	464		9												2		11
	467	+	27					2							15	2	46
	479	1	+												+		1
	480		2														2
	485	+			+											1	1
	486	+	+													+	
	487	+	20		1											2+	23
	505	+	7							1			2		6	+	16
	508a	+	+								1			+	+		1
	508b	+	+												+	1	1
	510a		+	1													1
48JO	510b	+											1				1
	511	3	10	1												+	14
	516		+														
48SH	163	+	+								2					1	3
	189	3	34							4							41
	199		3												+		3
	200	+	+														
	218		+												+		
48JO	417	+	8														8
48SH	168																
	183										+					+	
TOTAL		12	198	7	1	6	3	2	1	5	5	8	7	8	61	16	340
Frequency by artifact class		3.5%	58.2%	2.1%	0.3%	1.8%	0.9%	0.6%	0.3%	1.5%	1.5%	2.3%	2.1%	2.3%	17.9%	4.7%	100.0
Frequency by artifact group		64.1				3.3			3.3			2.3	2.1	2.3	17.9	4.7	100.0

Table 1: Euroamerican artifacts from the Western Powder River Basin site sample. All tobacco cans are Prince Albert type.

occupants and type of activity all have their particular archaeological fingerprint (Yellen 1977; Binford 1978; Hofman 1982). Thus, type and association of artifacts may carry meaning about past behavior. For example, several sheep shears were recorded during the survey described here. Although these are not unambiguously informative about site function, they offer some evidence to rule out certain alternatives, while suggesting other functions (see below).

STOCKRAISING SYSTEM FACILITIES

Several types of facilities, usually described as archaeological features, are important components of stockraising sites. Some of these, or their absence, can indicate site function and can be informative about spatial organization of the groups occupying the site. As an example of the former, a house implies a different activity than a corral. In terms of the use of space, the characteristics and distribution of, for example, the hearths and artifacts around them has implications about a variety of activities. These include solitary versus communal, long versus short term, ethnic affiliation, demography and so on (e.g., Williams 1968; Yellen 1977; Binford 1978).

Euroamerican sites in the Western Powder River Basin contain several different facilities. Because these imply different degrees and kinds of permanence, the facilities are first divided into structural and non-structural types. These are further divided into eleven facility classes (Table 2). The classes were derived by combining functionally (if known) and morphologically similar facilities from the total descriptive list of facilities. For example: dwellings, barns, and sheds were grouped into one class (dwellings/outbuildings); wells and cisterns were grouped into another class (wells); and so on. When only one or few facilities of a particular type were present in the total facility sample, their apparent importance to functional interpretation of the site dictated whether they received a separate class or were placed in the category "Other." Thus, wood and metal stakes, posts, and the like are in the "Other" structural category, while rock piles and sheepherder monuments each received their own facility category. The nature of the most numerous facility classes are discussed individually.

Dwellings and Outbuildings

Dwelling and outbuilding facilities include roofed structures such as houses, dugouts, "shacks," "barns" or stables, "garage-like" structures, and various others (e.g., Trewartha 1948). They vary in size, quantity, and effort expanded into building and maintenance from facility to facility and from site to site. This variability may hold important information about stockraising processes. Eighteen structural facilities are in the site sample analyzed and these occur at 26% (n=10) of the sites in this sample.

Livestock Control

Livestock control facilities are the next most numerous structural facilities and occur at 18% of the sites (n=7). The sample contains seven of these facilities or 8% of the facilities. Their morphological characteristics may show their function. Sheep pens tend to be more tightly constructed and lower than the cattle corrals because of the size differences in the animals. Both cattle corrals and sheep pens were recorded during the survey. In three cases, the activities associated with the corrals appear to be the major site function as they are associated with few other artifacts or facilities.

Fences are another important livestock control facility present in Wyoming since the early 1880s (Larson 1965:179). These occurred at several structural sites and elsewhere on the landscape, but were not separately recorded. Undoubtedly fence characteristics can yield information about stockraising processes. This is perhaps one of the least studied

Site	#	Environment		Site Size	Structural Features					Non-structural Features						TOTAL
		Topography	Altitude	Area in M²	Dwellings/ Outbuildings	Stock Control	Outhouse	Well	Other	Refuse Pile	Wood Pile	Hearth	Rock Pile	Sheepherder Monument	Other	
48JO	412	T	7,120	250	3	1 C.		1					1			6
	437	T	4,590	27,700	1	1 S.			1						1	4
	460	T	8,220	200	1					1						2
	481	T	4,120		1							1	1		1	4
	495	T	4,180		3		1		1							5
	498	R	4,220	1,500	1						1					2
48SH	165	T	3,720	5,000	4	1 C.		2	2						1	10
	225	T	4,010		2											2
48JO	392		8,800		1											1
	394		8,850		1		1			1	1					4
	435	T	4,500	375							1					1
	438	R	4,540								1					1
	444	T	8,800	144												
	457	R	4,760	956							1					1
	461	R	4,440	2,000						1	1					2
	462	R	4,400								1					1
	464	R	4,380	25						1	1					2
	467	R	4,320								1				1	2
	479	R	4,220								1					1
	480	R	4,220								1					1
	485	R	4,140								1					1
	486	T	4,100	250							1	1				2
	497	R	4,280						1	1	1					3
	505	R	4,140	600							1	2				3
	508a	R	4,460								1				1	2
48JO	508b		4,430						2		1					3
	510a	R	4,540	2,100						2	2			1	1	6
	510b	R	4,560								1					1
	511	R	4,120	600		1 S.					1					2
	516	T	4,660								1			1	1	3
48SH	163	R	4,100	750							1					1
	189	R	4,120	323												
	199	R	4,160	96							1	1				2
	200	R	4,130								1					1
	218	R	4,200							1	1					2
48JO	417		6,560	20,000		1 C.			1	1		1			1	5
48SH	168	T	3,740			1 C.										1
	183	T	3,900			1 C.			2							3
TOTAL					18	7	2	3	10	9	26	6	2	2	8	93
FREQUENCY					19.4	7.5	2.1	3.2	10.8	9.7	28.0	6.5	2.1	2.1	8.6	100.0

Table 2: Euroamerican facilities from the Western Powder River Basin site sample. Topography codes are T = terrace; R = ridge; S = sheep pen; C = cattle corral.

facilities of stockraising dynamics. Yet, it may hold information about use of landscapes of crucial importance to the understanding of stockraising and more encompassing cultural processes (e.g., Leone 1978; Hood, Bograd and Baram 1987).

Wood Piles

Wood piles or scatters are the most numerous non-structural facility type encountered. These vary from neatly stacked piles of logs to diffuse scatters of small pieces of wood chips. Locally available chopped or saw cut pieces of wood, brush (sagebrush), or manufactured lumber may be a part of a particular wood pile. Wood piles were present at 31% (n=5) of the structural sites and at 91% (n=20) of the non-structural sites. These are the most common facilities at the latter types of sites.

Refuse Piles

The next most common non-structural facilities in the sample are refuse piles. Among other items these contain variable number of cans, bottles, broken glass, pieces of wood, and paper. The largest refuse pile was at site 9, probably a central sheepherder camp with a large cabin, outhouse and a variety of other items (see below). Refuse piles appear with approximately equal frequency at structural and non-structural sites and are found at 25% (n=4) of the former and 23% (n=5) of the latter.

Hearths

All hearths, except one, were associated with non-dwelling sites. These hearths range from elaborate rock lined hearths to concentrations of charcoal or fire cracked rock on the ground surface. Only five sites (13.2%) contain hearths. This may be because most of the sites are in the basin at low elevations (4,000 to 4,500 feet ASL), and were probably winter occupations when most of the activity takes place inside sheep wagons (Fawcett 1981) and other enclosed quarters.

Other Facilities

Several other classes of facilities occurred at the recorded sites. These included wells, outhouses, rockpiles, sheepherder "monuments" (stacks of rock), windmill remains, clotheslines, wood troughs, metal and wood posts (stakes), salt licks, bedgrounds (areas where sheep are bedded at night or in storms), airplane landing strip, and the remains of an apparent stock loading ramp. One facility that was not systematically recorded is cut branches from living trees. Many trees, mostly juniper, were noted as having their branches cut. These, along with sagebrush, are the most available fuel sources in the basin areas. In the mountains trees and firewood are plentiful. The relationship of cut trees to the settlement system might be of interest. A further characteristic of these cut branches is their relative age. It appears that characteristics of cutting and healing of the branches may indicate a relative date of the cutting event. Clearly, this archaeological feature is perishable, but may provide important information about the settlement system and resource use (e.g., Castro, Hakansson and Brokensha 1981:413).

PUTTING IT ALL TOGETHER: STOCKRAISING SITE FUNCTION IN THE WESTERN POWDER RIVER BASIN

The function of some sites in the sample is obvious from the settlement model (Kornfeld 1983) and the archaeological record; these sites are discussed first. This is followed by a discussion of the remainder of the sites. The variability in their archaeological content is presented and arguments about their function are made based on the known sites and the model (Kornfeld 1983).

Ranch Headquarters

Two sites (1 and 3) exhibit characteristics expected of ranch headquarters. These characteristics include a substantial dwelling, outbuildings, and a corral. Such facilities suggest permanence or at least extended periods of occupation (several seasons). Site 1 is at a high altitude (7,120 feet ASL) and is thus interpreted as a summer ranch headquarters. On the other hand, site 3 is at low altitude and is interpreted as a winter headquarters. To illustrate further the characteristics of the ranch headquarters site type, details of these two sites are presented.

Site 3 has four dwelling and outbuilding features and includes a corral, two wells, a trough, flagstone flooring (perhaps an outside porch) and a fenceline (Figure 2). The dwellings and outbuildings consist of the ranch house, two stable or "barn" like buildings, and a root cellar (or dugout). The main house had cut loops and cement chink-

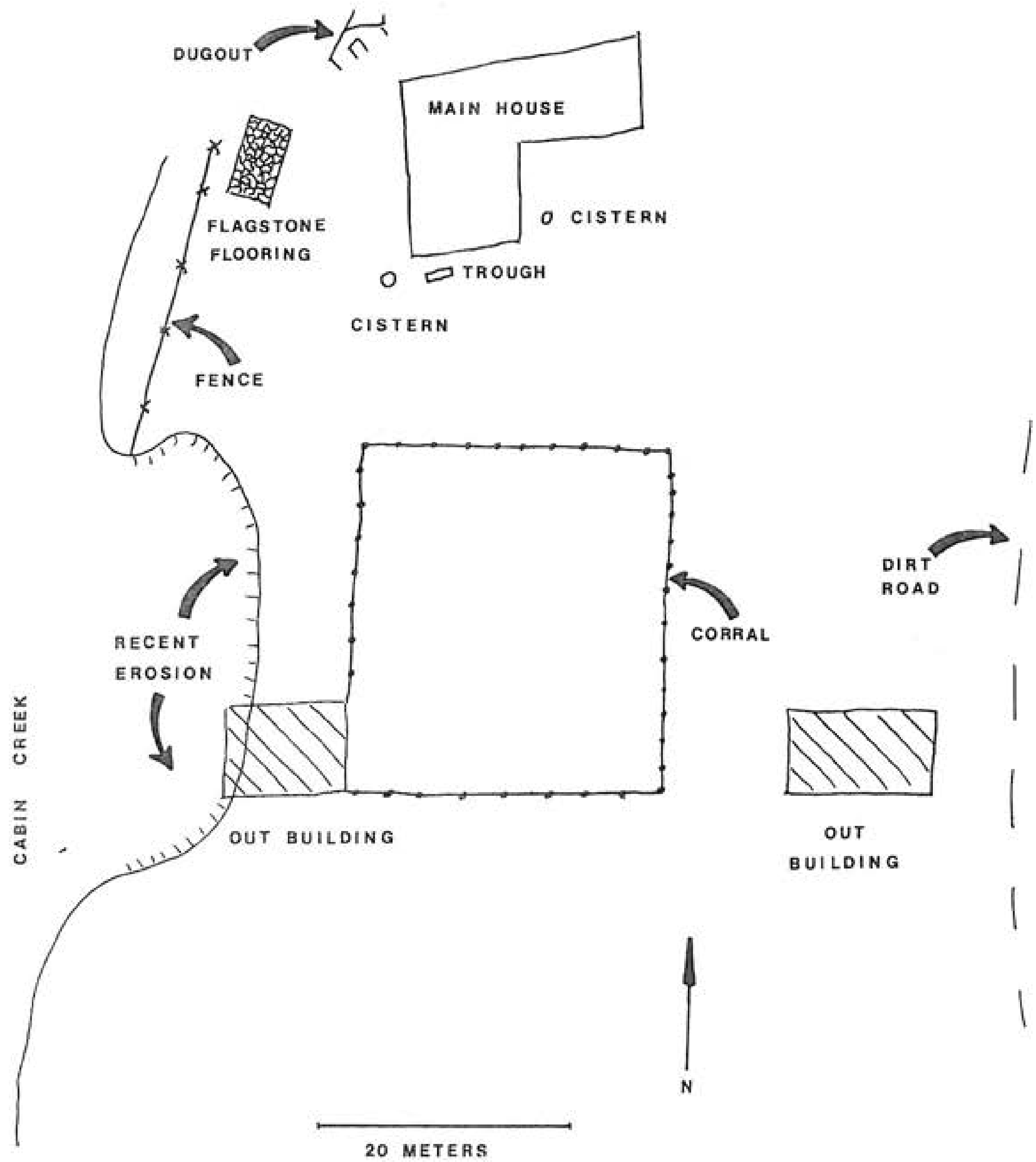

Figure 2: An example of a relatively elaborate ranch headquarters site type, site 3.

ing. The shingles on a part of the house are decoratively cut into various patterns (triangles, diamonds, etc.), an unusual architectural feature for rural homes.

Although artifact data was not systematically collected, some items noted inside the house include an "iron" stove, gas refrigerator, a four burner gas stove in the kitchen, and a mattress in one bedroom. A suitcase and several "de-alcoholized" (prohibition) beer bottles were found in the attic. Outside the house, several artifacts including a newspaper (with a caption "Buy War Bonds"), a 1938 vehicle license plate and flat-wound barbed wire were found. Many of these items seem to suggest use of this site before World War II.

The other ranch headquarters, site 1, is similar but less elaborate (Figure 3). Some differences between the two sites may be due to their season of occupation. For example, watering facilities could be absent at site 1 because water is more available in the mountains making wells and troughs less necessary. Other differences could be due to the number of inhabitants. For example, site 1 may be smaller because fewer people occupied it than site 3. Similar propositions may explain the other differences between these two sites (see Table 2). For an in-depth discussion of ranch headquarters, including some quantitative artifact data, see the reports on Johnny Ward's Ranch (Fontana et al. 1962), Rancho Punta de Agua (McGuire 1979) or Cochrane Ranch Site (Heitzman 1980).

Roundup Sites

Three sites exhibit characteristics expected of roundup sites (Table 2). These characteristics include all or some of the following features: corral, fencing, loading ramp, trash dump, and hearth (indicating a branding or camping area). Two of these sites are located in the basin and one in the mountains. The latter (site 6) is the best preserved and may still be in use. This site is used to illustrate the roundup site pattern.

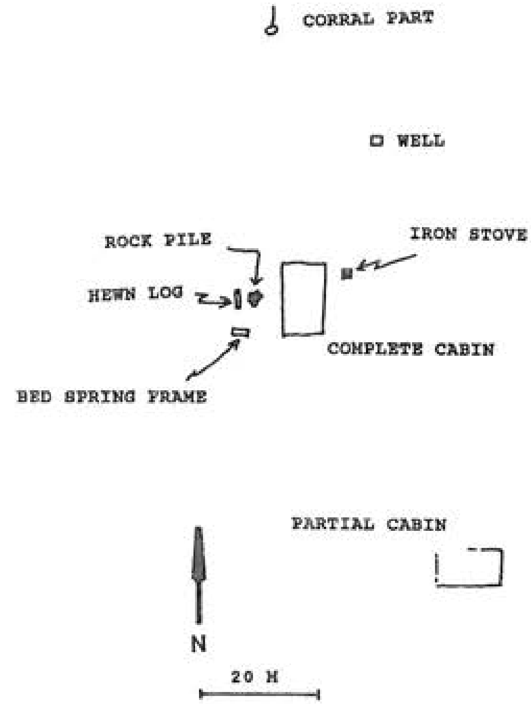

Figure 3: An example of a simple ranch headquarters site type, site 1.

Site 6 has a corral, a fence line, a hearth, a refuse pile, and a trail (Figure 4). The triangular corral is located with ridges on three of its sides. Trees are used as two of the corner posts. A gate is at the third corner post with a fence-line extending southwest from the gate and slightly downhill. A refuse pile containing bottles, cans, and jars is located in a swale about a hundred meters from the corral. A hearth is located less then fifty meters south of the corral and several cans are in the vicinity. The trail is about one hundred meters south of the corral, oriented in an east to west direction across a low ridge.

Central Sheepherder Camps

The site sample includes two central sheepherder camps. One is in the mountains, while the other is in the basin. The function of the former was determined with ethnoarchaeological data, while the function of the latter was determined based on archaeological data

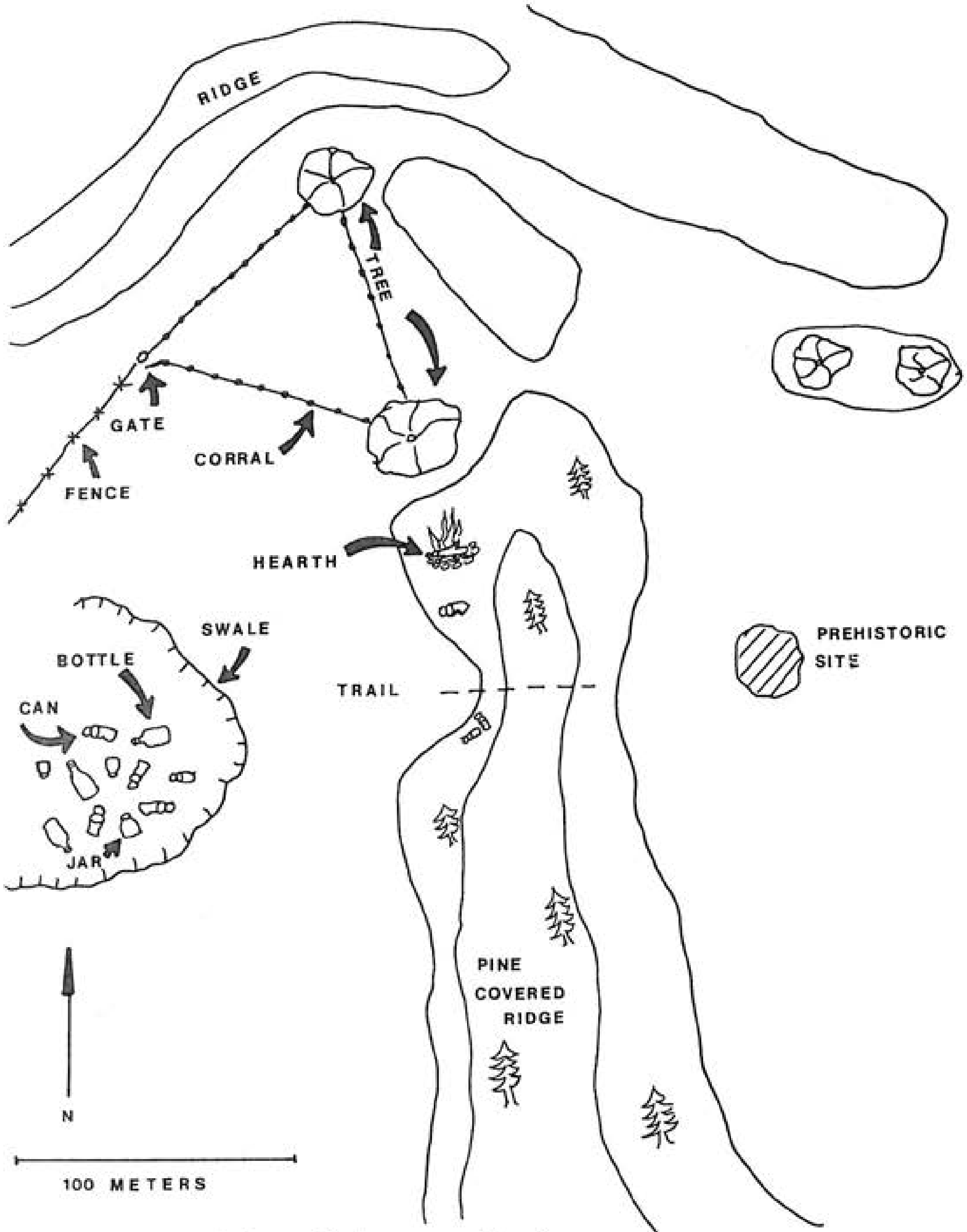

Figure 4: Stock control (corral) site type, site 6.

only.

Site 9 is in the Big Horn Mountains. The current occupant indicated that it is a part of their family's sheep ranching operation. Its characteristics indicate that it is a central sheepherder camp. This site has a cabin, a collapsed outhouse, a refuse pile, and a wood pile. The cabin is fairly large (approximately 3.5 x 4.5 meters) and consists of what appears to be the original cabin and a later addition (Figure 5). Each of these sections contains one room. The refuse pile is some distance from the cabin and contains cans, bottles, jars and other trash. This is the largest refuse pile in this sample of sites (Table 1 does not include quantified information from this

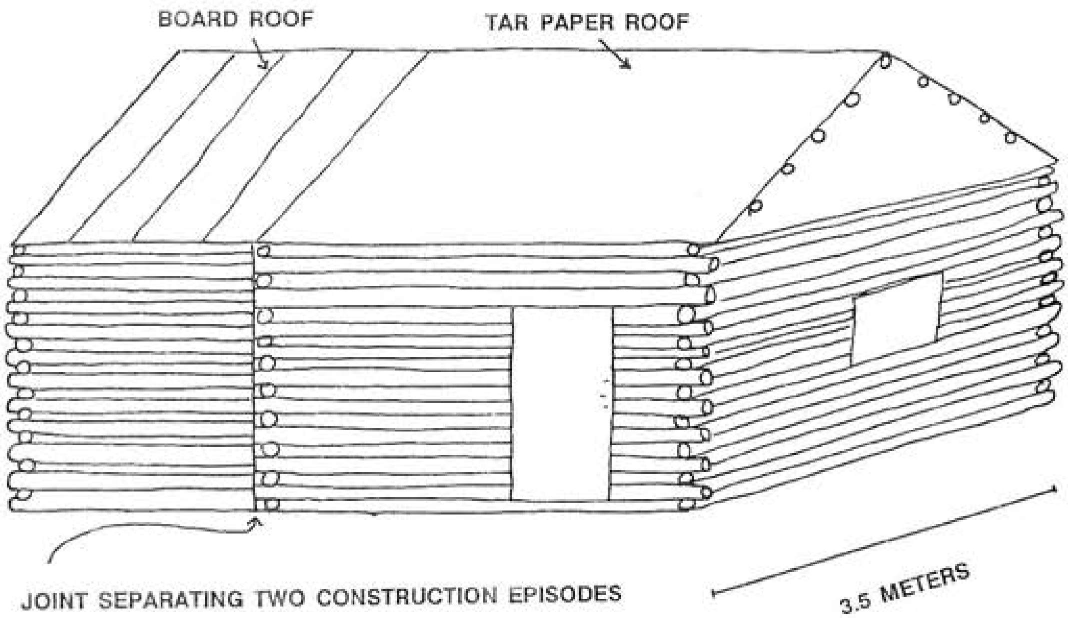

Figure 5: The main dwelling, a cabin, at a summer central sheep camp, site 9 (note change in roof and wall construction indicating cabin expansion).

facility). A flock of sheep and a variety of trash, tools, and other items were scattered over the area defining the rest of the site. The size of this site, including the large refuse pile and the outhouse, suggests permanent summer occupation and therefore a central sheepherder camp.

Site 10 is in the basin. It also appears to be a central sheepherder camp with shearing/docking/shipping facilities. The site is poorly preserved; many of its artifacts and facilities may have eroded away or are buried. Nevertheless, some basic observations can be made. Along with a large, round, elaborate sheep pen, this site contained a structure (house), a windmill, and a trough (Figure 6). The sheep pen was located across the creek about 150 meters from the structure. The site also contained broken glass, eating utensils, a part of a stove, metal (irrigation) pipes, and several other items (see Reher 1979:222). These features indicate a site occupied for a considerable period and can thus be classified as a central sheepherder camp. The model suggested that shearing/docking/shipping tasks may occur at spring-fall central sheepherder camps.

Shearing/Docking/Shipping Sites

Only one site (No. 12) was found where shearing/docking/shipping tasks represent the major activity. The only two facilities at this site were a square sheep pen and a wood pile (Figure 7). Typical camping debris including glass, cans, and utensils were present in association with these facilities. No permanent or long term occupation is suggested by any of these facilities except the sheep pen which indicates occasional use during shearing, docking or shipping of the flocks.

Other Sites: Structural

To discuss the function of the rest of the sites in this sample, the sites are divided into those containing structural facilities and those without such facilities (see Table 2), with several exceptions. First, the sites with livestock control facilities are eliminated from fur-

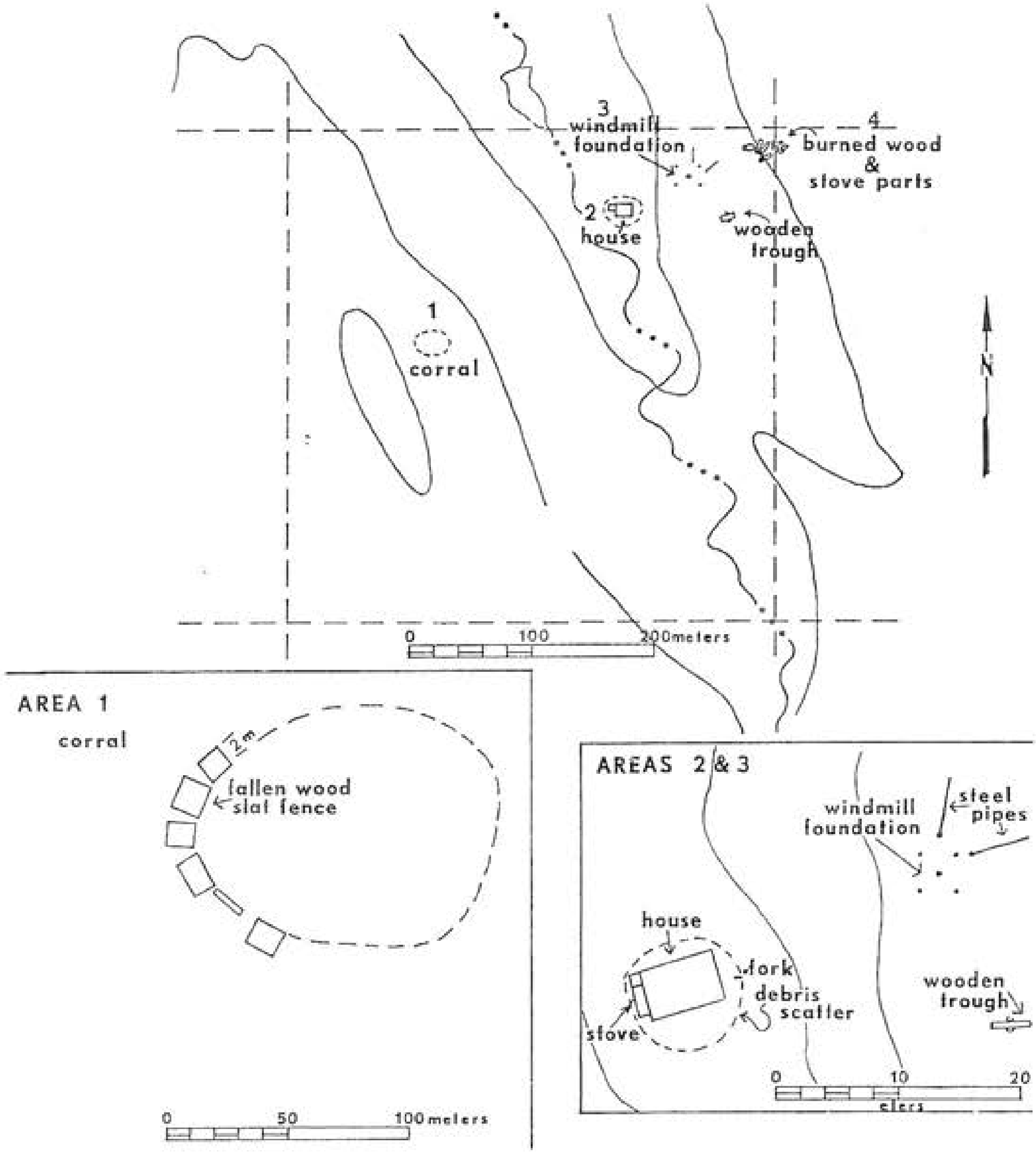

Figure 6: Central sheepherder camp in the Powder River Basin, site 10. Top: site map; bottom: details of areas 1, 2, and 3.

ther discussion in this section. Second, sites 28 and 30b, both containing posts or stakes as the only structural facilities, are discussed with non-structural sites. It is argued that these non-structural facilities are indicative of a behavioral context unlike dwellings, outbuildings, wells, and the like.

Four sites with structural facilities have been identified as to their function in the settlement system; two ranch headquarters and two central sheepherder camps. However, six sites with structural facilities remain of "unknown" function. To compare the characteristics of the "known" to the "unknown" sites, the number of facilities was plotted against the number of sites (Figure 8). This results in a bimodal distribution, with three sites in each mode occurring at two and four facilities. The two modes separate the complex sites on the right from the simpler sites on the left side of the graph. Two of the sites on the right

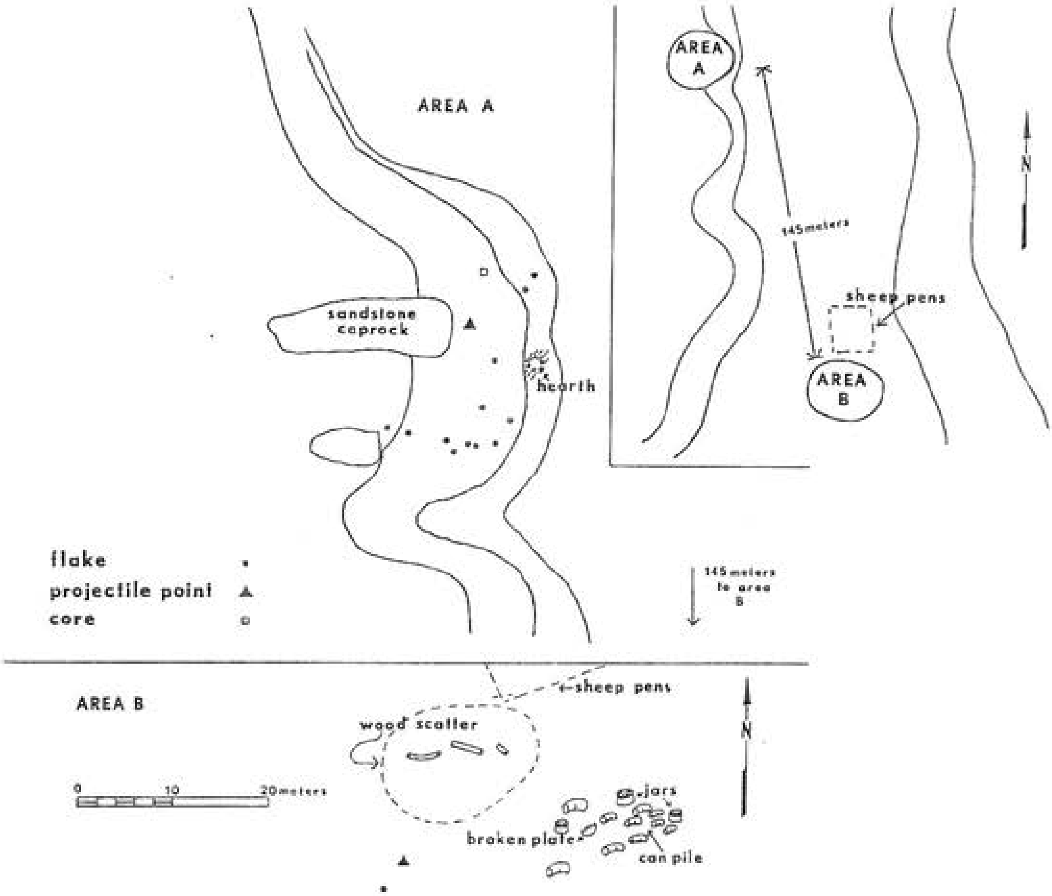

Figure 7: Shearing/docking/shipping site type, site 12. Area A is an unrelated prehistoric site. However, Area B contains both sheepherding and prehistoric artifacts, a common co-occurring set of artifact types.

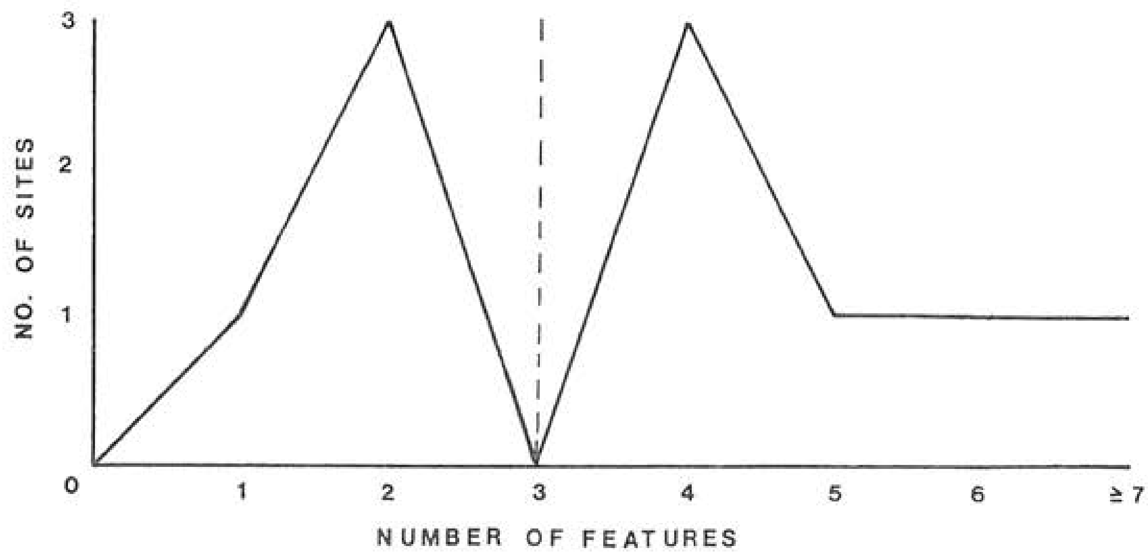

Figure 8: Absolute frequency of features at structural sites.

have been identified as ranch headquarters, two as central sheepherder camps, and the other two have not been discussed. On the left, none of the sites have been identified to their function in the stockraising settlement system.

Sites 2 and 13 are the unidentified, complex sites and sites 4, 5, 14, and 19, are the unidentified, less complex sites. Examination of facility types at these sites should give clues about their role in the settlement system. To begin with, the two complex sites (2 and 13) are quite different from each other. The latter (site 13) is the only structural site with a hearth, one of two sites with a rock pile, and the only site in the sample with an airplane landing strip. The former (site 2), on the other hand, has three structures, an outhouse and a clothesline. These differences are further illustrated by plotting only the number of dwellings/outbuildings by the number of sites (Figure 9). Again, a bimodal distribution appears at one and five facilities, with four sites in the former and two in the latter mode. This dimension of variability separates the two sites in question. Site 2 falls in the cluster with the sites in the higher mode (n=5 dwellings/outbuildings), while site 13 clusters with the sites in the lower mode (n=1 dwellings/outbuildings). Since two of the three sites in the upper mode have been identified as ranch headquarters, this suggests that site 2 is also a ranch headquarters.

But what about the function of site 13 and the other four less complex structural sites? It can be suggested that two of these are sheepherder cabin camps (sites 14 and 19). Sheep remains are often observed at sheepherder camps and sheep or sheep remains were observed at these sites (see Table 1; all bone recorded was sheep). It is not known whether these are the result of butchering, culling, or sheep that died from disease or predators. Both sites are clearly temporary. Site 14 can be described as a shack with scattered trash (cans, jars, etc.). The shack itself is only

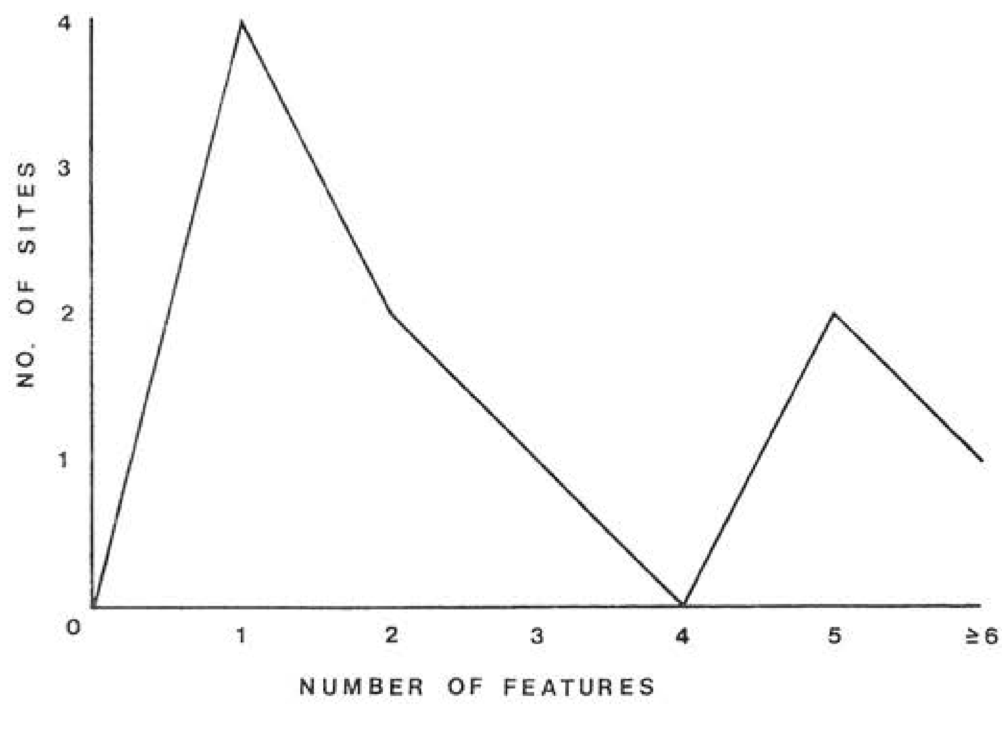

Figure 9: Absolute frequency of dwelling/outbuilding features at structural sites.

3.6 x 2.2 meters, containing a pine needle covered, built-in bed, which takes up about half of the structure. This structure is similar to a sheepwagon except for the lack of mobility.

Three of the less complex sites still have not been pigeonholed into a role they played in the stockraising system (sites 4, 5, and 13). The last, site 13 is probably a special site of recent origin not considered in the model. This is indicated by the presence of an airplane landing strip. Perhaps this site serves as a location where emergency supplies can be brought in for the stock in the winter. Its proximity to several large sheepherding outfits indicates its probable association with the sheepherding system. The first two sites (4 and 5) may be line shacks. Their structural features are somewhat more permanent than the sheepherding related structures described above, yet they are not as complex as a ranch headquarters.

Other Sites: Non-Structural

The last set of sites discussed include 63% (n=24) of the sample population. Two of these sites contain posts as the only structural facilities (28 and 30), while the rest of the sites contain no structural features. Given the settlement system models described previously (Kornfeld 1982, 1983) and if the present sample represents the region, many of these sites should be sheepherder camps, while a few could be cattle drive camps or line camps. Since these types of sites are temporary living locations or overnight resting places for a few people and often reoccupied, finding clear archaeological criteria to differentiate them is unlikely. Shelter at both sites may have been wagons, tents, or none at all, while food refuse (cans, jars, etc.) is the most frequent item expected. Instead of guessing at the differences between cattle drive camps (or line camps) and sheepherder camps, this section discusses the variability in the non-structural sites. Since most of these are sheepherder camps as indicated in the model (Kornfeld 1982, 1983), this discussion will be most useful in understanding the archaeological record and variability of this site type.

To begin, out of these 24 sites, one contained a pair of sheep shears, another sheep remains (bones), and two other sites contained sheepherder "monuments." Three of these sites (30a, 11, and 31) are clearly sheepherder camps because sheep remains and sheepherder monuments are not expected at cattle drive camps. The role of site 20 in the stockraising system, however, is ambiguous. Sheep shears can function in both a cattle ranching system and a sheep ranching system. In sheep ranching, shears are most often associated with shearing activities. These usually involve a somewhat large task specific group and shearing facilities, if these are available. Through time as large outfits replaced the small growers (Reighter 1982), the shearing has gotten more formalized in terms of organization and facilities used. In a cattle ranching system, shears would be most useful during spring drives and roundups to expose the brand from under the heavy winter coat (George C. Frison, personal communication, 1980). Thus, in both systems, shears are used in the spring, the activities involve large task groups, but sheep shearing generally involves facilities not found at site 20. Besides, the location of the site on a ridge makes it an unlikely spot for shearing facilities. Stock corralling is usually done in low spots, where natural factors can be used in helping to control the animals. Thus site 20 is likely a camp for a task specific group, possibly a cattle drive group where the animals can be kept an eye on from the camp on the ridge.

Of the non-structural sites, two contained no facilities, one contained six facilities, while the rest contained from one to three facilities (Figure 10). Data (Table 2) indicate the facilities present at non-structural sites (the "Other" category under non-structural features includes troughs, landing strip, salt lick, and bed-

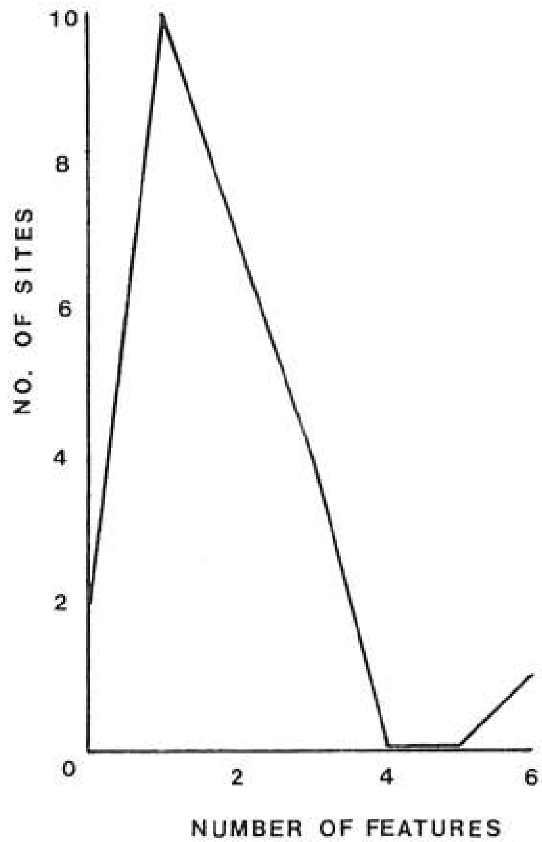

Figure 10: Absolute frequency of features at non-structural sites.

ground). Wood piles (scatters) are present at 92% of these sites. Refuse piles are the second most frequent facility, occurring at 25% of the sites, followed by the hearths. Only four hearths are present at the non-structural sites, two of them occurring at the same site.

The site areas of non-structural sites range from 25 to 2,000 square meters, with a mean of 685 square meters and a standard deviation of 695 square meters (n=12). In terms of site content, the sites range from a scatter of several pieces of glass, associated with a wood pile (site 16), to a site with complete jars, 27 food cans, 15 tobacco cans, a wood pile, a trough, and a variety of other artifacts (site 23).

Site 20 is one of the largest non-structural sites. The function of this site was discussed above. The site covers 2,000 square meters and contains two facilities, a wood pile and a refuse pile (Table 2). The items on this site are relatively abundant (n=42) and include sheep shears, tip plate, rifle cartridges (n=6), Prince Albert cans (n=7) and food cans (n=21). The items are on a ridge or just off the ridge in a little swale to the east or on the western slope of the site (Figure 11).

Three other sites will be presented to illustrate the structural variability of these sites (sites 33, 17, and 11; Figures 12, 13, and 14 respectively). Site 17 and 33 are somewhat unusual for sheepherder camps in that neither of them have wood piles. However, they show interesting and potentially meaningful internal structural differentiation.

Site 33 encompasses an area of about 323 square meters (Figure 12). It is on the northwest side of a ridge and there is a slight slope to the north of the site. Thirty-five cans, three bottles and four fragments of leather are present. The cans appear to be scattered randomly over the entire site. The bottle and leather fragments are somewhat more concentrated. It is hard to say, however, whether this is related to location of activities associated with these artifacts or to the vagaries of discard. Artifact distributions may also be a result of downhill erosion as the main axis of their distribution is downhill. In other words, site 33 may be showing very little behaviorally meaningful structural differentiation.

Site 17 (Figure 13) is in the Big Horn Mountains, on the north side of a steep draw at the edge of the timber, offering a good view to the east and north. This site is somewhat smaller than site 33, encompassing about 144 square meters. The site contains one glass item, 15 food and condensed milk cans, one pan, and 14 tobacco cans (modern Prince Albert type). The location of the glass bottle was not given, but the distribution of the mapped items indicates structural characteristics contrasting with those described for site 33. Most of the food and condensed milk

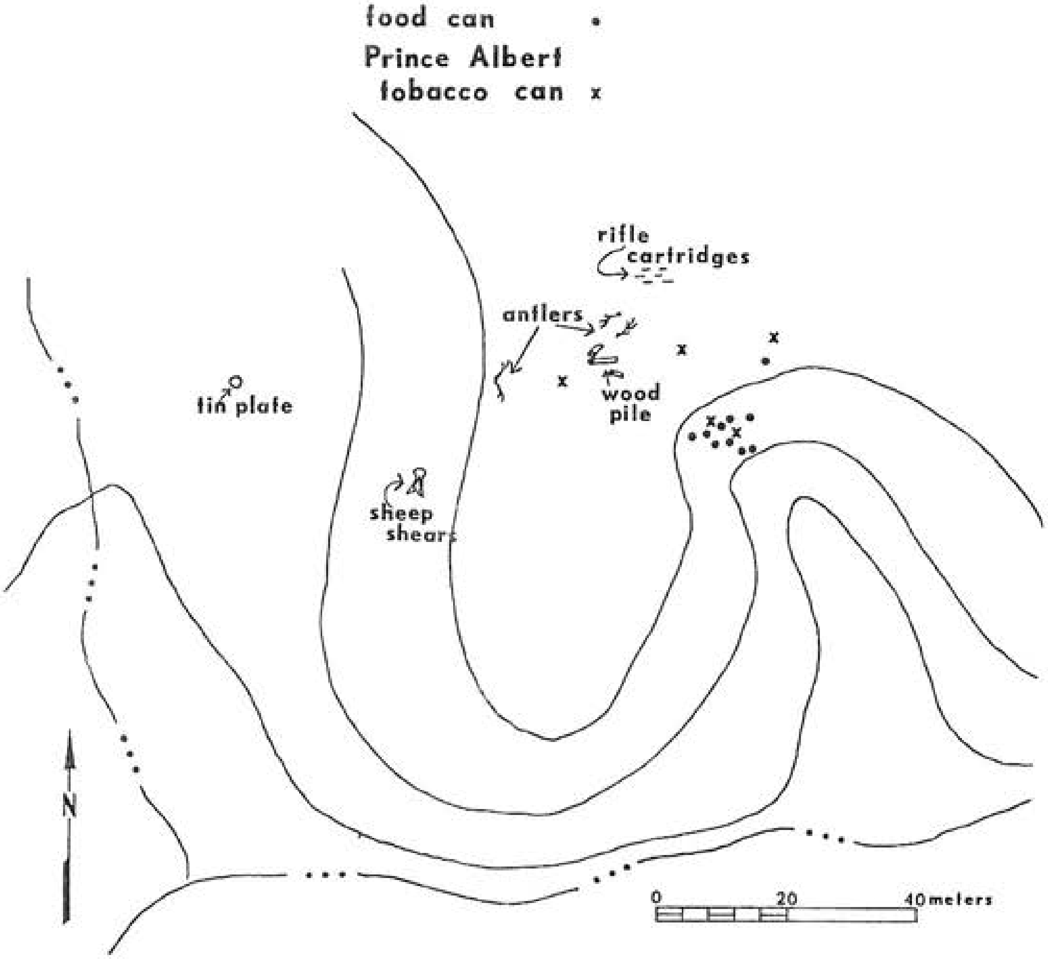

Figure 11: Large sheepherder camp with a relatively large and diverse assemblage, site 20.

cans are located in a refuse pile along the edge of the arroyo. The tobacco cans are separated from the food cans by a clear area of several meters and are more scattered. The enamel pan is some distance from food and tobacco can concentrations. This spatial organization of artifacts is more likely to have behavioral meaning than the spatial arrangement at site 33. For example, it can be suggested that cooking took place near the pan and that a fire was either in the wagon or obliterated by some post occupational process. Dirty, pest attracting trash was thrown some distance from the living area, while less bothersome trash was thrown near or within the living area.

Estimates of length of occupation, the number of occupants, or the number of reoccupations can perhaps be made based on the number and types of cans and other evidence yet unrecognized by archaeologists. The tobacco cans are an indication of the total occupation time, although whether they indicate multiple occupations or one long term occupation is not immediately obvious (see Hofman 1982 for a similar argument). In either case, tobacco cans tend to be discarded when used up. Since sheepherders generally spend their time away from the camp this is where such cans are often discarded. In fact, the tobacco cans may indicate short term rest stops at an occasionally occupied camp, also represent-

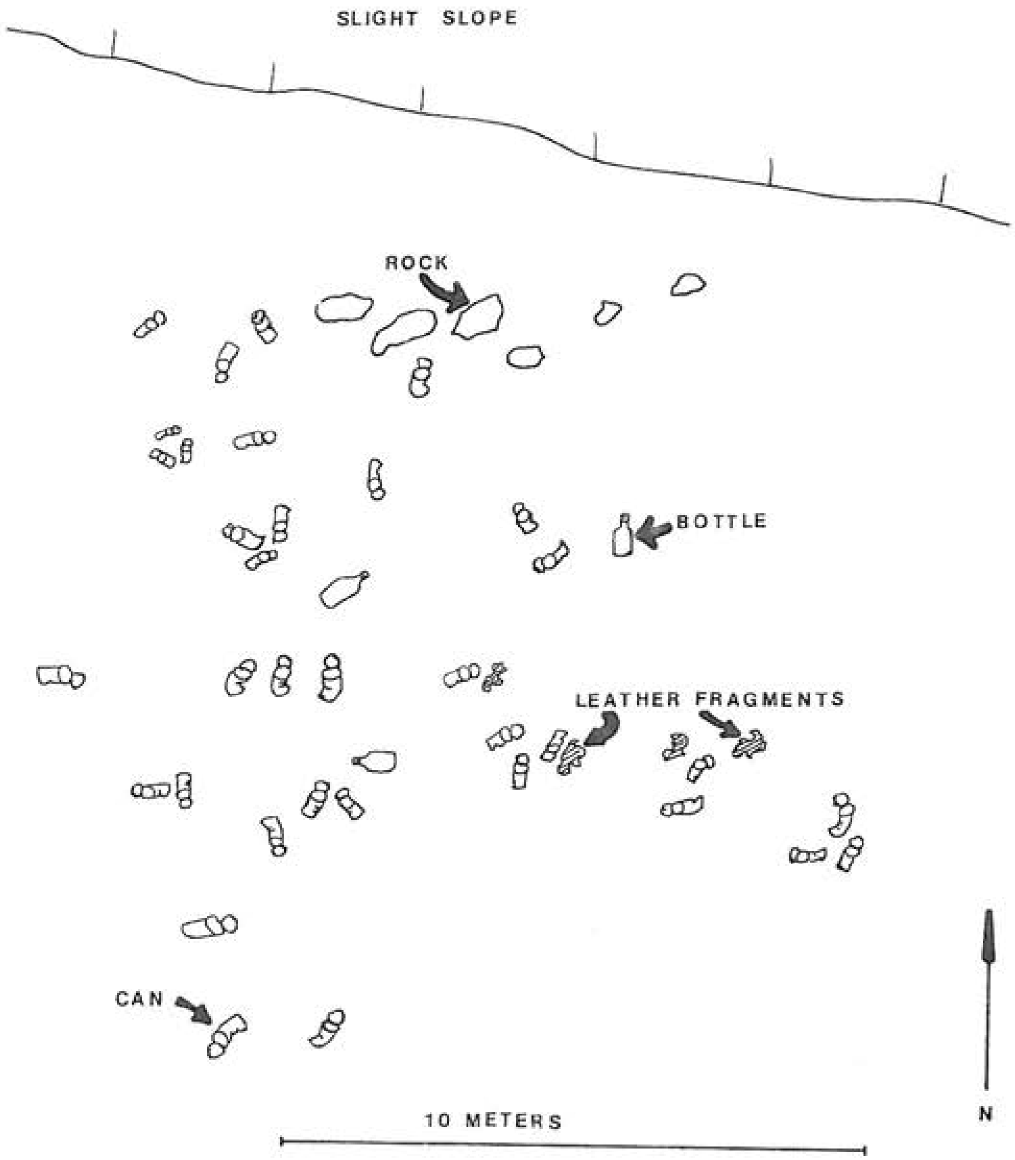

Figure 12: Sheepherder camp with a spatially homogeneous artifact distribution, site 33.

ed by other items at the site. Although this is speculative, underlying such statements are demonstrated structural differences between these sites as seen in their respective sketch maps.

To further illustrate archaeological variability, the last non-structural site to be discussed is site 11 (Figure 14), which is much larger than the other two sites (about 5,500 square meters consisting of two areas not combined in Table 2). It is on top of a small ridge on the northwest side of a small drainage. The site includes more than six food and condensed milk cans in one refuse pile, an unspecified number of items in another, one metal pan and two wood piles. A sheepherder monument is about 40 meters to the west of the site and another activity area is about 100 meters to the north (site 11b).

Although several interpretations are possible, there is a spatial association between the refuse piles and the wood piles. It is provocative to think of each of these areas associated with a sheep

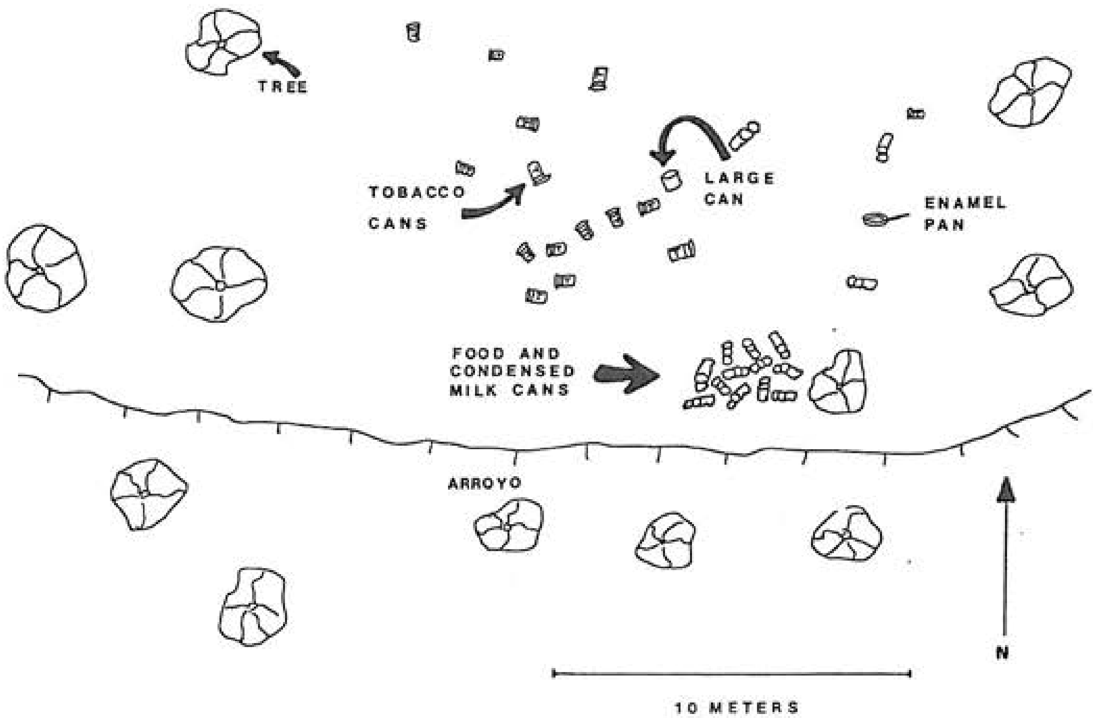

Figure 13: Summer (mountain) sheepherder camp with some distinct artifact clustering, site 17.

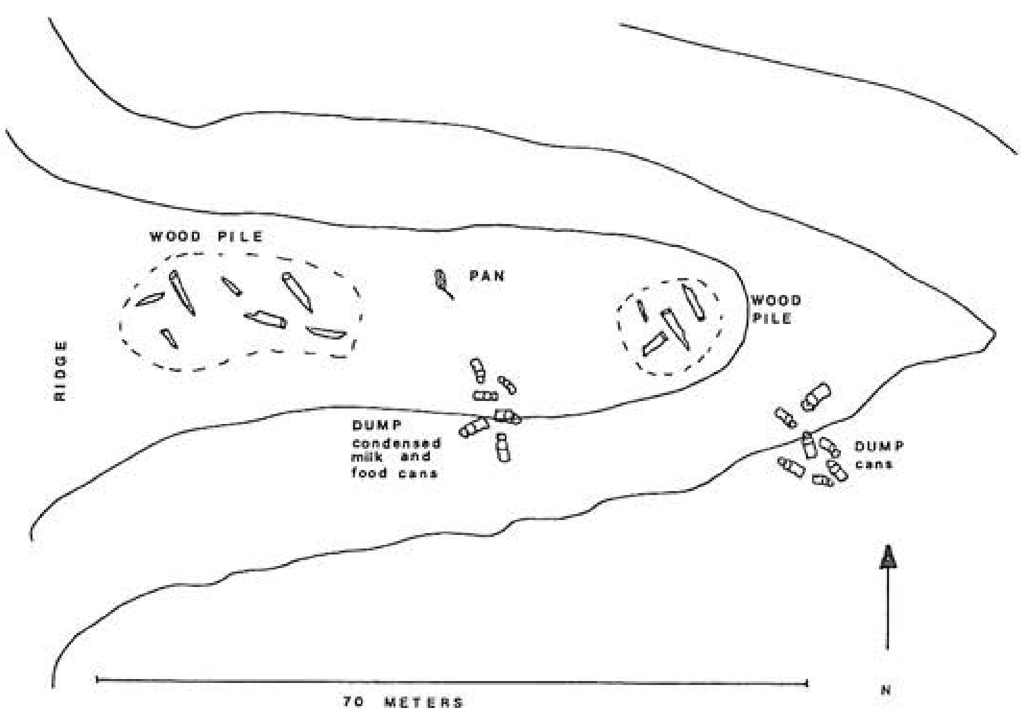

Figure 14: Unique sheepherder camp (site 11), showing a dual structure, indicating either reoccupation or a shipping/docking/shearing locality occupied by two sheep wagons.

wagon. Ethnographically, the wood pile is often located to the side of the door of the wagon and the refuse is in the toss zone (Binford 1978) of the door (Erickson 1979). The two areas may have been occupied simultaneously or on different occasions, but perhaps the presence of two wood piles indicates a simultaneous occupation. In other words, a later occupant would probably have pirated the wood from the earlier occupant's wood pile if the occupations were not simultaneous. Thus, only one wood pile, but two refuse piles would remain. Such is not the case, and a single occupation with two wagons is postulated. However, the detailed characteristics of the wood piles are not known and this argument would only hold if the piles contain substantial quantities of wood.

Site 11 is unusual in the number of facilities and site size. Site 11a (the main site area) is separated from the other sites by at least two features as no sites with four and five features are in the sample (Figure 10). The reason for this large number of features may be the occupation of the site by two occupants as is postulated above. Although two herders are sometimes said to work together (Sypolt 1974), judging by the rest of the sites this seems to be an unusual situation. Perhaps this site is a camp associated with shearing/docking/shipping site and two herders were necessary to handle the animals. Although a sheep pen is not present, some support of this function can be found in site size. The lack of a sheep pen may suggest a portable pen was used.

Shearing/docking/shipping activities are expected to require larger amounts of room than other sheep ranching activities. Thus, these types of sites should cover larger areas (Figure 15). All nonstructural sites and shearing/docking/shipping sites are represented on the graph. Although the sample is small, site 11 is clustered with the larger sites on the right side of this graph. Of four other sites on the right side of this graph, two have been identified as shearing/docking/shipping sites. This lends support to the functional interpretation of site 11.

SUMMARY

The goal of this study was to describe the characteristics and present some variability among the archaeological record of the Rocky Mountain stockraising system. The artifacts and facilities described, and their variation, were used to assign the sites a role in the stockraising system (Table 3). Although some sites may be recorded in government documents and other written records, other sites may be documentable through oral histories. It is virtually certain that no ethnographic or historical information is available for most of the sites. As a result, the archaeological record described here is the only evidence of many stockraising cultural processes in the Western Powder River Basin. A similar situation exists throughout much of the Rocky Mountain area and the western United States and probably also in other areas of Euroamerican stockraising (e.g., Argentina, Australia, New Zealand; see Strickon 1965). It is true that historical records searches should be a part of any study of Euroamerican stockraising (which was not done extensively here). It is also the case that the archaeological record will have to be used as the primary, and sometimes the only data, for a complete understanding of stockraising processes. For this reason, the present paper described some archaeological variation of stockraising sites and showed some ways of interpreting these characteristics.

ACKNOWLEDGMENTS

M.L. Larson and W.B. Fawcett, Jr. helped in many stages of this study. Colleagues at the University of Massachusetts have contributed by making the senior author more aware of the cultural processes approachable with the Euroamerican stockraising archeology. In addition, Wyoming and Colorado cattle and sheep ranchers, whom we have known over the years, have helped us to understand the nature of stockraising.

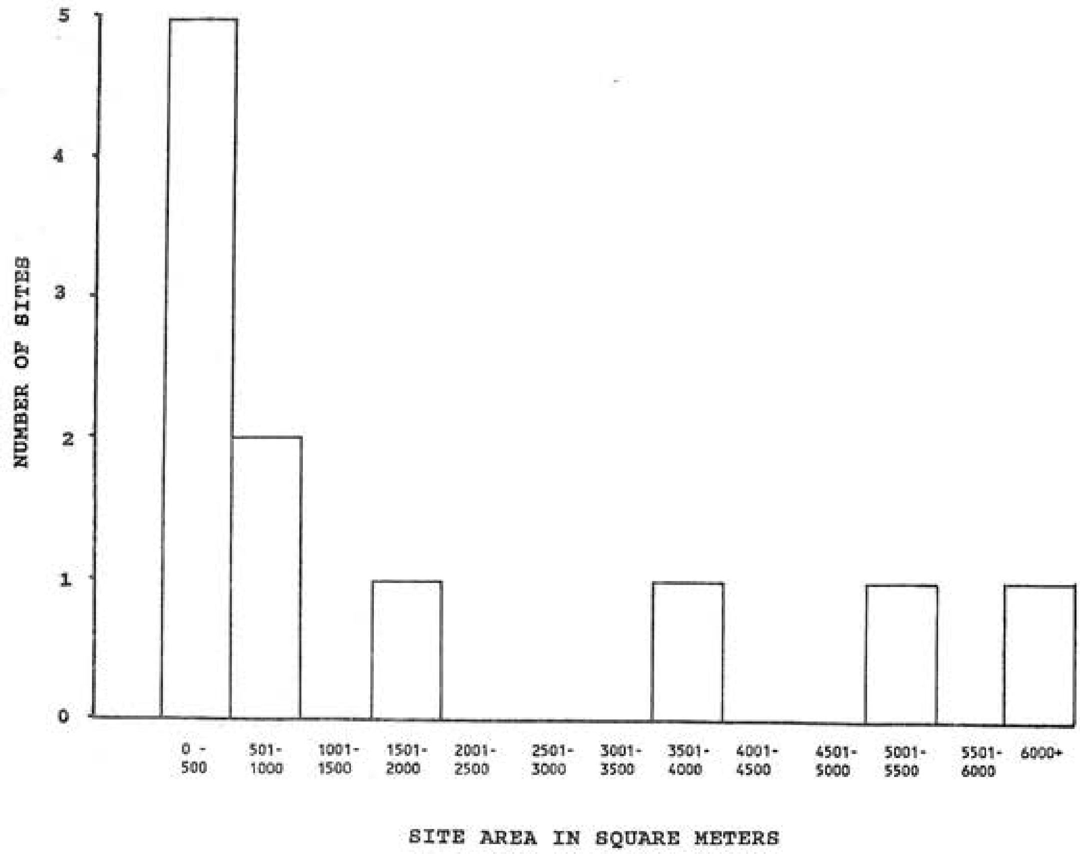

Figure 15: Distribution of sites sizes classes (in square meters).

Finally, the original version of this study appeared as a portion of the senior author's MA thesis at the University of Wyoming chaired by G.C. Frison. Other members of the committee, C.A. Reher, A.P. Glascock, and P. Fowler contributed to the cohesiveness of this study. To all these individuals in the Year of The Sheep 4688, we owe a great deal.

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SITE TYPE	SMITHSONIAN SITE NO.	SITE NO. IN PAPER
Ranch Headquarters	48JO412	1
	48JO495	2
	48SH165	3
Line Shack	48JO498	4
	48SH225	5
Stock Control (corrals)	48JO417	6
	48SH168	7
	48SH183	8
Central Sheep Camp	48JO394	9
	48JO437	10
Shearing/Docking/ Shipping	48JO510	11
	48JO511	12
Unknown	48JO481	13
Sheepherder Camp	48JO392	14
	48JO435	15
	48JO438	16
	48JO444	17
	48JO457	18
	48JO460	19
	48JO461	20
	48JO462	21
	48JO464	22
	48JO467	23
	48JO479	24
	48JO480	25
	48JO485	26
	48JO486	27
	48JO497	28
	48JO505	29
	48JO508	30
	48JO516	31
	48SH163	32
	48SH189	33
	48SH199	34
	48SH200	35
	48SH218	36

Table 3: Western Powder River Basin stockraising site typology and site numbers used in this paper.

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OBSIDIAN PROJECTILE POINTS FROM THE LAWRENCE SITE (48TE509) NEAR JACKSON LAKE IN NORTHWESTERN WYOMING

by
Michael R. Peterson

ABSTRACT

The Lawrence site (48TE509) lies southeast of the Arizona Creek entry into Jackson Lake in Grand Teton National Park, and encompasses an area of over a square kilometer. The Lawrence collection consists of obsidian projectile points and possible knives that were surface finds collected by Slim Lawrence in the early 1900s. The thirty-nine projectile points and knives in this discussion represent a sample of the Lawrence collection that were selected based on material type and point chronology. The material types represent several sources of obsidian found within a 75 km radius of the site. These sources were determined by examining the artifacts with the use of x-ray florescence. The projectile point chronologies range from Late Paleoindian to Late Prehistoric with most being Early Plains Archaic Period dart points. Morphological characteristics, material types, dates and sites of similar projectile points types are examined. Attention here will focus on the Early Plains Archaic and the Late Paleoindian Cascade-type projectile points from the Lawrence Collection.

THE LAWRENCE SITE

The Lawrence site is the largest base camp in northern Jackson Hole recorded to date. The site consists of a series of overlapping sites and separate site areas. The site is triangular-shaped with the boundaries lying between Honeymoon Bay, Indian Island, and the picnic area on Highway 89-287 (see Figure 1). The elevation of the site is between 6730 and 6772 feet. The site is over a square kilometer in area and includes at least nine site areas. The eastern-most boundary appears to be on a sandy cove on the east side of Honeymoon Bay. Archaeological materials extend north of Jackson Lake on the east side of the Snake River and continue north of the Grand Teton National Park boundary. However, the extent of the major concentrations of cultural materials ends at the picnic area on Highway 89-287. The western boundary extends as far west as Indian Island and possibly further (Conner 1986). The site has produced over 800 projectile points, over 200 bifaces, over 500 grinding slabs and stones, 13 whole, broken, or unfinished steatite vessels, and hundreds of cores, flakes, and tools (Reeve et al. 1979). Fire hearths or pits are also a dominant feature at the site and form a large component of the beach cobbles.

HISTORICAL BACKGROUND OF THE JACKSON LAKE AREA

The earliest occupational evidence for humans in the Jackson Lake area dates from about 9000-10,000 years ago (Conner 1986). There has been continued occupation since then. Several late Paleoindian projectile points were collected by Slim Lawrence and the National Park Service. They include Cody complex, Cascade-type projectile points and other late Paleoindian lanceolates (Figures 2 and 3). Earlier projectile points such as the Clovis and the

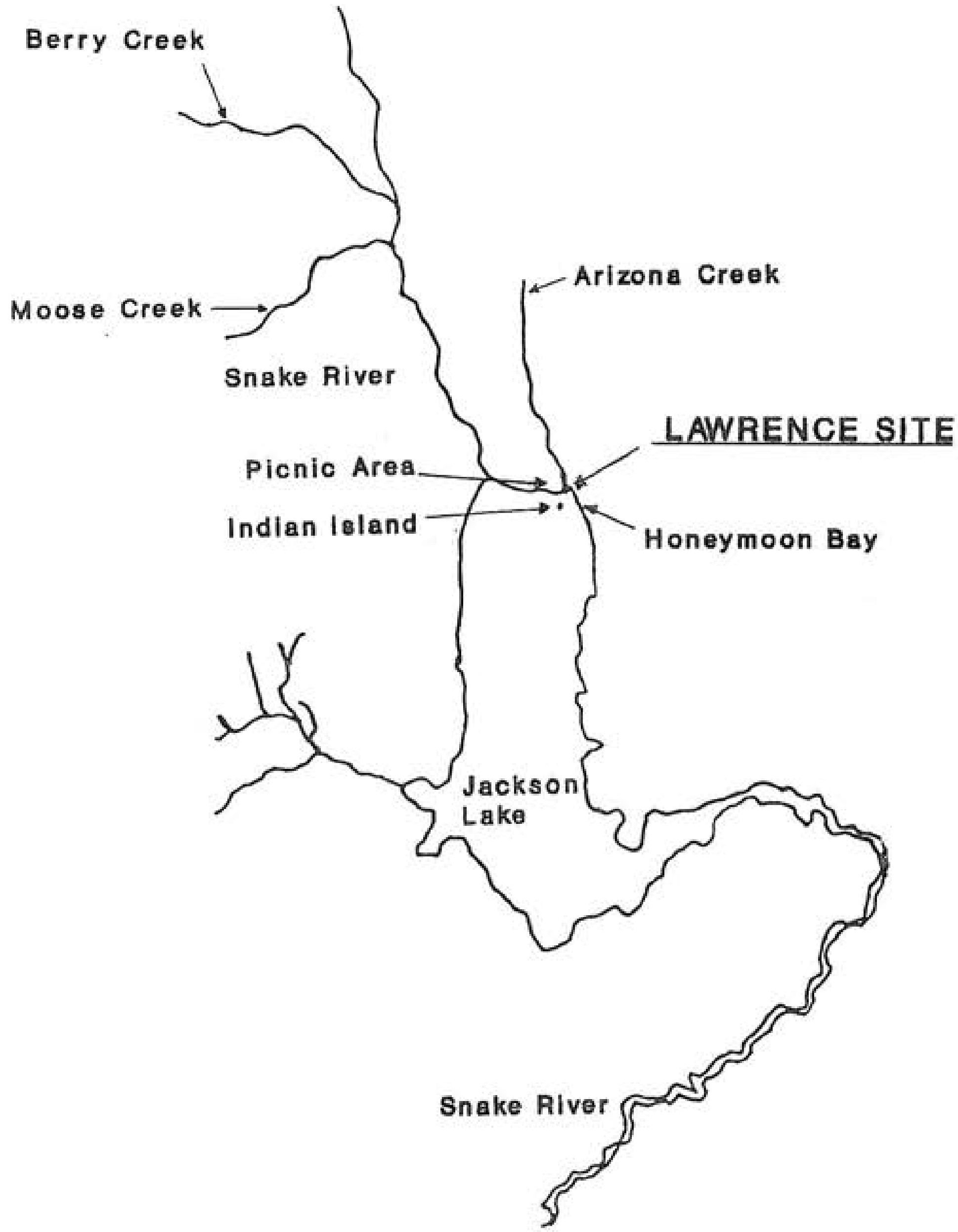

Figure 1: The Lawrence site, located on pre-dam Jackson Lake.

Folsom are rare in this area.

The Archaic period at Jackson Lake is represented by all Plains Archaic sequences. The Early Plains Archaic assemblage of the Lawrence site obsidian collection consists of side notched dart points (Figure 4). No radiocarbon dates from Jackson Lake have been obtained; however, artifacts have been placed into this period by obsidian hydration dates (Conner 1986). Radiocarbon dates from other nearby sites of this period include the Lookingbill site in northwest Wyoming, dating from 5190 B.C. ± 160 years to 5030 B.C. ± 230 (Frison 1983). Another date of 4380 ± 130 B.C. (I-2358) is from Mummy Cave, also in northwest Wyoming (Husted and Edger

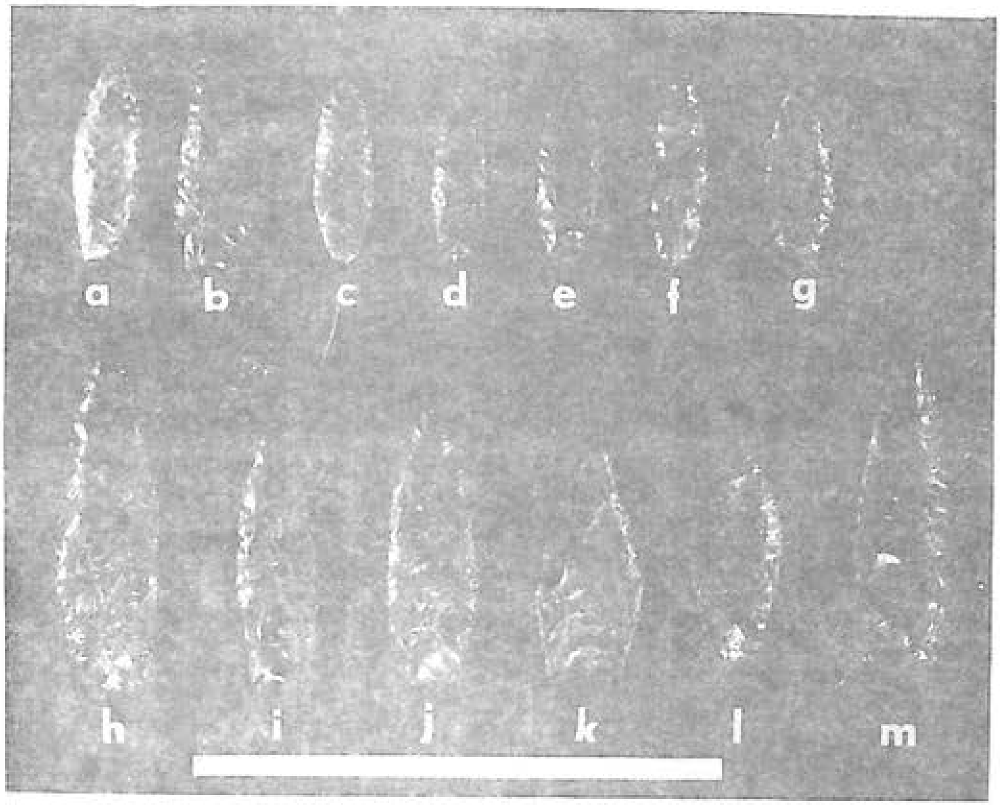

Figure 2: Paleoindian projectile points and knives from the Lawrence collection.

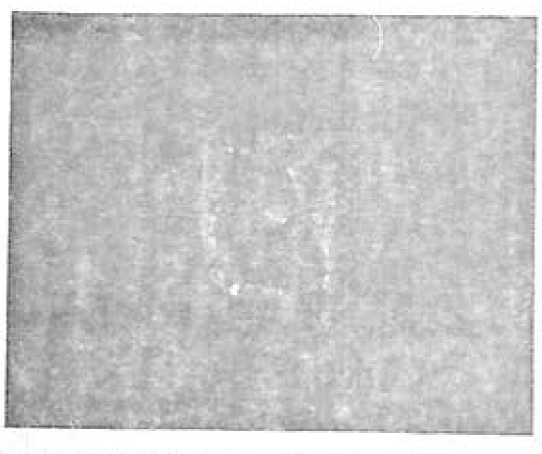

Figure 3: Paleoindian projectile point midsection from the Lawrence collection.

n.d.).

Artifacts from Mummy Cave's Early Plains Archaic levels include side notched projectile points, awls, gravers, scrapers, and knives. At the Lookingbill site, an unusual occurrence of manos, grinding slabs, and a fire-fractured rock-filled fire pit appeared. These artifacts and features indicate that human groups were increasing their emphasis on plant foods (Frison 1978). Side notched points, gravers, spurred-end scrapers, and single-beveled knives also constituted part of the Early Plains Archaic assemblage at the Lookingbill site.

The Middle Plains Archaic period at Jackson Lake included projectile points associated with the McKean Complex (Figures 5a-5d). Along with these diagnostic projectile points, rock-lined fire

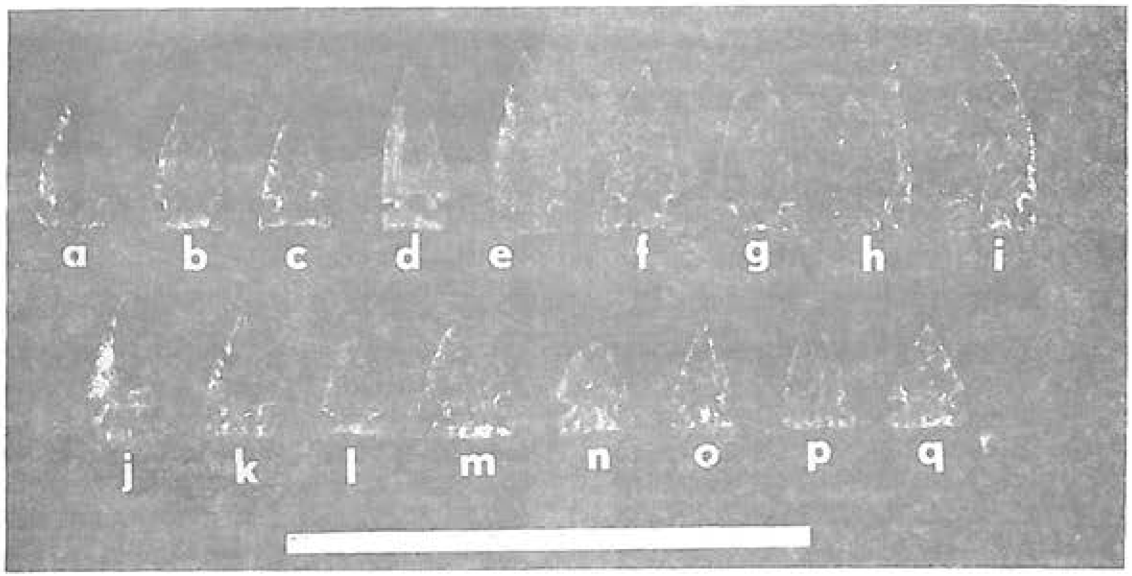

Figure 4: Early Plains Archaic projectile points from the Lawrence collection.

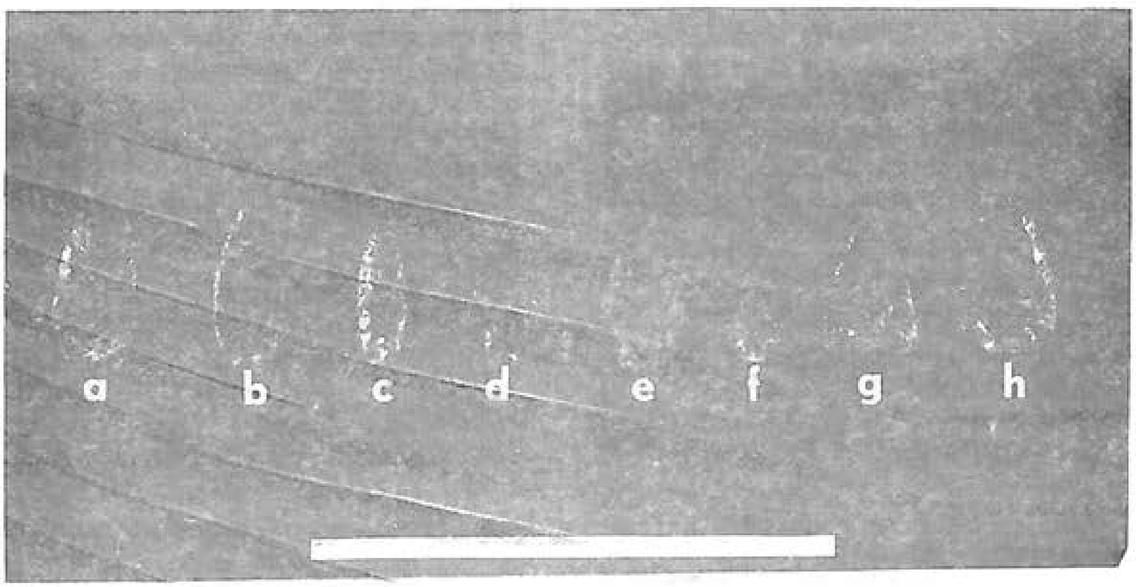

Figure 5: Middle Plains Archaic, Late Plains Archaic, and Late Prehistoric projectile points from the Lawrence collection.

pits, grinding stones and slabs are also chronological markers at Jackson Lake for this time period. An increased use of these artifacts and features proliferated during this period and continued through the later periods. At the Lawrence site, one fire pit was radiocarbon dated at 4440 $\pm$ 75 B.P. (DIC-1375) (Reeve et al. 1979). Other dates are available from this time period, such as those from the Dead Indian Creek site in the Sunlight Basin in northern Wyoming of 4400, 4200, and 3800 B.P. The site produced McKean projectile points similar to the ones contained in the Lawrence collection (Frison and Walker 1986).

The Late Plains Archaic Period at Jackson Lake is evident by corner notched projectile point styles. Included in the obsidian sample from the Lawrence collection are projectile points resembling this style (Figures 5e, 5g, 5h). A radiocarbon date for this time period from the Lawrence site gave a date of 2225 ± 135 B.P. (GX-11612). Another radiocarbon date of 2820 ± 135 B.P. (I-1427) from the Mummy Cave site is also in association with corner-notched points.

The Late Prehistoric period is a period noted for a change in hunting technology. During this phase, the bow and arrow replaced the atlatl and projectile point sizes were reduced. Most, but not all, projectile points of the later stages of this period are side notched points, sometimes with a basal notch. Another projectile point associated with this period is a small corner-notched point. During this time period, a pottery tradition called Intermountain, usually affiliated with Shoshonean groups, appears in this area. It appears indigenous to the Northwestern Plains (Frison 1978), however its original source could be somewhere else. Steatite vessels of the same flat, flanged-base flower pot shape as the pottery also appear in this area. Steatite vessels and a few pottery sherds are included in the Lawrence collection. One of several corner notched projectile points (# 612) from this time period is included in the obsidian sample from the Lawrence collection (Figure 5f). Two radiocarbon dates for this time period from the Lawrence site are 1045 ± 75 B.P. (GX-11611) and 1190 ± 75 B.P. (GX-11610) (Conner 1986).

LAWRENCE COLLECTION PROJECTILE POINTS

The Late Prehistoric Period

A Late Prehistoric period projectile point from the collection (# 612) is a small corner-notched projectile point with serrated edges (Figure 5f). This arrow point is 23.12 mm long, 14.96 mm wide, and 3.49 mm thick. The base is convex with an irregular flaking pattern. The material type is obsidian from Teton Pass or Fish Creek (see Figure 6 and Table 1).

An arrow point similar to this point was recovered from the Lookingbill site (Frison 1983:Figure 7q). A radiocarbon date from a fire pit associated with the same level as the point was A.D. 1530 ± 110 years (RL-1759).

The Late Plains Archaic Period

Three projectile points (#'s 0, 42, 46) from the Late Plains Archaic period are in the collection (Figures 5e, 5g, 5h). Figures 5h and 5g display the large, open corner notches with the sharp points that are formed as the blade edges intersect the notches. The blade edges are convex in shape and the points surfaces display irregular to parallel flaking patterns. The lengths are 46.50 mm and 41.43 mm, with widths being 28.42 mm and 27.60 mm. Thicknesses are 6.26 mm and 5.27 mm. The point in Figure 5h is made on a flake with the dorsal surface completely flaked. The ventral surface shows the flake scar, with edge retouch only. The original flake scar is exposed on the one face. The ventral surface had the bulb of percussion flaked off, and the edges were retouched only around the tip. The base for the point in Figure 5h was also slightly ground. The material type is Obsidian Cliff. The material type for Figure 5g is Teton Pass or Fish Creek obsidian (see Figure 6 and Table 1).

The other Late Plains Archaic dart

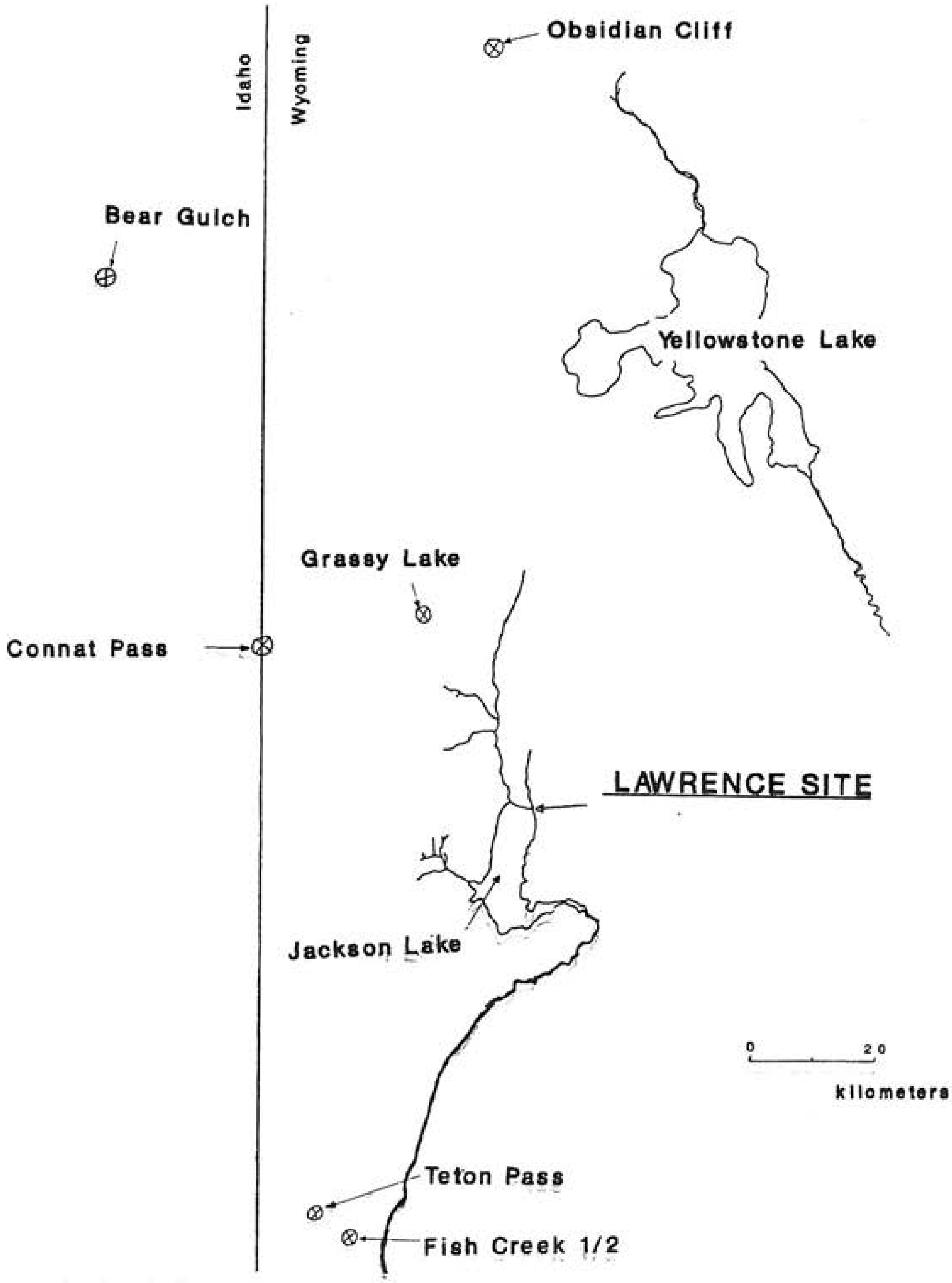

Figure 6: Probable source localities of the Lawrence collection projectile points and knives.

point, Figure 5e, demonstrates the same notching type as the above. However, the blade shape is straight, and the flaking pattern is a parallel herringbone pattern. The dimensions are 38.33 mm long, 25.16 mm wide and 6.11 mm thick. The material is ignimbrite from Grassy Lake (see Figure 6 and Table 1).

	LPI	EPA	MPA	LPA	LPR	Total
Obsidian Cliff, Yellowstone N.P	1	4	3	1	--	9
Bear Gulch, Targhee N.F.	4	1	--	--	--	5
Grassy Lake, WY	--	--	--	1	--	1
Connat Pass, WY	--	1	--	--	--	1
Teton Pass/Fish Creek, WY	5	10	1	1	1	18
Fish Creek, WY, second variety	3	1	--	--	--	4

Table 1: Summary of obsidian sources by time period. LPI = Late Paleoindian; EPA = Early Plains Archaic, MPA = Middle Plains Archaic, LPA = Late Plains Archaic, LPR = Late Prehistoric.

The Middle Plains Archaic Period

Middle Plains Archaic Period projectile points (# 44, 43, 112, 45) included in this collection are shown in Figure 5a-5d. The three McKean points (Figures 5a, 5b, 5c) have convex blade edges, concave bases, and irregular flaking patterns, except forthe point in Figure 5c which has comedial irregular flaking. There is no apparent grinding on the hafting elements or bases. The lengths for these three (Figures 5a, 5b, 5c) are 52.66 mm, 49.20 mm, and 40.20 mm long. Widths are 24.26 mm, 49.26 mm, and 40.20 mm wide. The thicknesses are 7.95 mm, 3.77 mm, and 5.56 mm thick. The material for Figure 5a is obsidian from Teton Pass or Fish Creek. The material for the other two points is obsidian from Obsidian Cliff (see Figure 6 and Table 1).

The other McKean projectile point (Figure 5d) is a shouldered point, with convex blade edges and a concave base resembling the Humboldt Concave Base A Pinto Series. These points are named after the Humboldt Lakebed site (NV-CH-15) in west-central Nevada where they commonly occur, but seem to have a wide distribution in the Great Basin (Clewlow 1967). Projectile points that also resemble these types of points are from Coyote Flat in southeastern Oregon. The dimensions of this point are 44.53 mm long, 24.50 mm wide, 5.86 mm thick. The flaking pattern is irregular; hafting element is ground; and the material type is Obsidian Cliff (see Figure 6 and Table 1).

The Early Plains Archaic Period

Most of projectile points in the collection are represented by a specific type of Early Plains Archaic period side notched projectile point (#'s 214, 223, 231, 203, 205, 207, 227, 226, 229, 208, 232, 230, 213, 221, 278, 233, 210) (Figure 4a-4q). This specific type resembles projectile points associated with sites in the northeastern Great Basin in Utah, the Columbia Plateau in Oregon and Idaho and the northwestern parts of Wyoming (Figure 6). These points have several names and are associated with different dates or time periods according to their geographical areas. Morphological characteristics, such as notches and base shape, seem to remain constant throughout the geographical areas and time periods.

The morphological characteristics of the Lawrence side notched projectile points are triangular with convex blade edges. The notches are shallow, square to U-shaped, high on the blade and are, in some cases, asymmetrical. The base shape is either straight or concave. In two cases it is convex. The flaking pattern for 70 percent of the points is parallel diagonal with the flakes directed toward the base. Twenty-three percent of the points demonstrate random/irregular flaking patterns and five percent of the projectiles demonstrate comedial flaking. The points also have evidence of resharpening. It is evident on several points the blade length is shorter in relationship to the base width and the blade edges are offset from the original medial ridge. Points in Figures 4f, 4a and 4o show signs of the original flake surface. The surface on the dorsal face of the flake was removed, and the ventral surface was marginally retouched. An interesting note on the flaking on one projectile point is that, in the flaking process, a flake did not carry across the face of the point, instead it hinged. At this stage, the knapper used the hinge for a platform and drove another flake. Waldorf (1984:30) calls this technique the "Stack Technique." Several of these points demonstrate flakes terminating in the middle of the point with a hinge. Grinding on bases is slight and not as heavy as expected on Early Plains Archaic points.

The dimensions for these points (given as maximum, minimum, and average for length, width, and thickness) are maximum length 62.65 mm, minimum length 26.61 mm, and average length 40.03 mm. The maximum width is 27.98 mm, minimum width is 18.44 mm, average width is 22.05 mm. Maximum thickness of the points is 6.28 mm, minimum thickness is 3.72 mm, and average thickness is 5.18 mm. Material types represented for the Early Plains Archaic points are from several sources. Eleven projectile points are from the Teton Pass/Fish Creek source. Three projectile points are from Yellowstone Cliff. Two projectile points are from Targhee National Forest, and one projectile point is from Fish Creek II (see Figure 6 and Table 1).

This Early Plains Archaic projectile point is identified by a multitude of names. It is abundant in collections throughout the Columbia Plateau and in the Birch Creek valley in eastern Idaho and the Snake River in southern Idaho where Swanson et al. (1964) has named it the Bitterroot side notched point. Gruhn (1961) at Wilson Butte Cave named this side notched variety the Northern side notched. At Hogup Cave in northwest Utah, Aikens (1970) uses the names Bitterroot side notched and Elko side notched. According to Jennings (1980), the latter type was incorrectly classified and should be classified as the Northern side notched variety. Frison (1983:Figure 7a-7d) describes these points as Early Plains Archaic side notched projectile points. Still another name for this type of point is the Pahaska side notched, named by Husted and Edger (n.d.) for several projectile points recovered from layers 17 and 18 at Mummy Cave. Similar types of points were also found in Danger Cave in northwest Utah (Jennings 1957).

Dates of these projectile points have a wide range because of the long duration of this point type. In the Birch Creek Valley and southern Idaho, Northern side notched points were present at the end of the Birch Creek Phase, which dated from ca. 7000 B.C. to ca. 5000 B.C. and the following Bitterroot Phase, which dated from ca. 5000 B.C. to ca. 1000 B.C. (Swanson et al. 1964). At Wilson Butte Cave, the Wilson Butte IV assemblage dated ca. 4500 B.C. (Gruhn 1961). At Fort Rock Cave in Oregon, the Northern side notched points were associated with a level that dated to ca. 5000 B.C. (Layton 1972). Layer 16, under layers 17 and 18 from Mummy Cave in Wyoming which dated to 5680 ± 170 B.C. (I-1588) is believed to be about 500 years older than the other two levels (Husted and Edger n.d.). The Northern side notched occupation from Sudden

Shelter in central Utah, strata 5 through 7, was a short duration that lasted from 6600 to 6300 B.P. (Jennings 1980). This contrasts to the long duration at Danger and Hogup Caves, also in Utah, which spanned a time period of 8000 to 1000 years B.P. (Jennings 1957; Aikens 1970). An obsidian hydration date of a Bitterroot type (No.309-48-387) from the Lawrence site was dated at 3524 B.C. ± 213 (Conner 1986).

The Late Paleoindian Period

Six Late Paleoindian points (#'s 68, 102, 106, 103, 6, 105) included in the collection are Cascade-like points (see Figure 2a, 2c-2g). Cascade type projectile points were defined by Butler (1961). The geographical distribution of this point type describes an arc around the northern and western periphery of the Great Basin. They are abundant from the Columbia Plateau south to the Northern periphery of the Great Basin. They are particularly abundant at the latitude of the Fort Rock Valley in central Oregon; however they are absent from collections south of the Nevada-Oregon border. They are again abundant in the Surprise Valley in northeastern California and are relatively absent from collections east of the High Rock Country of northwestern Nevada (Layton 1972) (see Figure 7).

The Cascade-like projectile points from the Lawrence collection are medium to small lanceolate projectile points with rounded bases, convex blade edges, a slightly beveled or rhomboidal-like cross-section, and parallel oblique flaking. Evidence of grinding is apparent on approximately one-third the length of the point. The average length of the points is 54.51 mm, the average width is 17.87 mm, and the average thickness is 7.33 mm. The beveled cross-sections are possibly derived from resharpening in the haft. This is because the blade edge width immediately becomes narrowed and a bi-bevel appears above the grinding. Figure 2f shows signs of peculiar surface grinding on each face of the base. The material type for Figure 2a and 2c is Fish Creek obsidian. The material type for Figure 2d and 2e is Targhee National Forest obsidian. The material type for Figure 2f and 2g is Teton Pass/Fish Creek obsidian (see Figure 6 and Table 1).

The Bruces Eddy site on the north fork of the Clearwater River near the town of Ahsahka in northwestern Idaho contained a point similar to the one described above. It was 50 mm long, 19 mm wide, and 6 mm thick. The outline is lanceolate shaped, pointed at the tip with a rounded base. The flaking was parallel flaked with a lenticular cross-section, and the widest area is about one-third the way from the base (Lynch et al. 1965).

The Indian Well I site (45KL42) is approximately 180 miles east of the mouth of the Columbia river in the Dalles region east of the Cascade mountains in Washington (Butler 1961). Butler (1958) describes points contained in the site that are smaller to medium-sized leaf-shaped or Cascade-type points. These were rhomboidal in cross-section and frequently showed fine parallel flaking. Butler (1961) said most are made of cryptocrystalline, one or two are of basalt, and two are of obsidian. Butler says Indian Well I may date from 7500-8500 B.P. or earlier.

The Southsider cave in northcentral Wyoming contained a level that yielded a Paleoindian "projectile point that in outline form resembles a later type known as McKean lanceolate" (Frison 1978:40:Figure 2.5a). The blade edges were ground approximately one-third up from the base, the flaking was parallel oblique, and the material was Morrison quartzite. "The level was dated at 8500

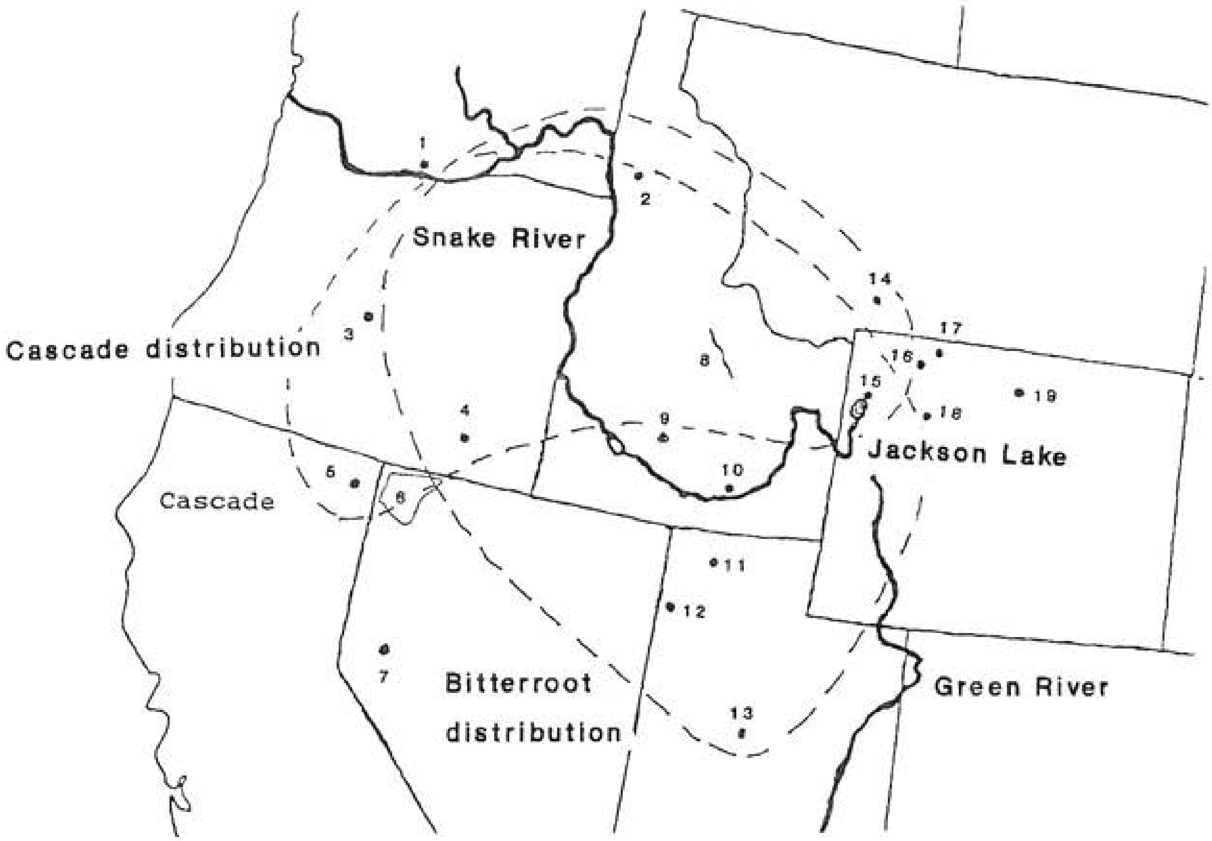

Figure 7: Geographical distributions of Bitterroot and Cascade projectile points, and archaeological site localities. 1 = Indian Well I; 2 = Bruces Eddy site; 3 = Fort Rock Valley; 4 = Coyote Flat; 5 = Surprise Valley; 6 = High Rock Valley; 7 = Humboldt Lakebed site; 8 = Birch Creek sites; 9 = Wilson Butte Cave; 10 = Baker Cave III; 11 = Hogup Cave; 12 = Danger Cave; 13 = Sudden Shelter; 14 = Myers-Hindman site; 15 = Lawrence site; 16 = Mummy Cave; 17 = Dead Indian Creek site; 18 = Lookingbill site; 19 = Medicine Lodge Creek site.

B.P. (RL-666)" (Frison 1978:40). This point only slightly resembles the Cascade-type or the points from the Lawrence collection.

Another site that contains the Cascade-like points is the Mangus site in Carbon County, Montana, located in the upper Yellowtail Reservoir area on the Bighorn River. Occupation I of the site contained two proximal fragments with convex lateral edges and bases. The chipping was parallel-oblique, both faces were retouched, and the lateral and basal edges are ground smooth. Grinding was estimated to extend approximately one-third the length of the larger fragment. The estimated length of the complete point is 60 mm, the width is 20 mm, and it is 6 mm thick. A radiocarbon date from this level is 6010 $\pm$ 150 B.C. (SI-308) (Husted 1969).

Two larger Cascade-like points (#'s 80, 87) also included in this collection are Figures 2i and 2j. They resemble the Cascade points depicted by Brian (1980:Figures 11 and 12). The Lawrence

Collection point in Figure 2i is 73.34 mm long, 24.48 mm wide and 6.74 mm thick. The blade edges are convex with contracting basal edge margins. It has a straight base with grinding that extends about one-third the length up from the base. The widest area occurs at the top of the grinding and also about one-third the length up from the base. The point has an irregular flaking pattern and is made of obsidian from Targhee National Forest (see Figure 6 and Table 1).

The other projectile point (Figure 2j) is a large lanceolate 80.26 mm long, 26.32 mm wide and 7.29 mm thick. The blade shape is straight to slightly convex, with contracting basal margins and straight base. Grinding extends approximately one-fourth the length up from the base. The widest area also occurs at the top of the grinding. The flaking pattern is irregular/comedial, and the material type is obsidian from either Teton Pass or Fish Creek. Two projectile points that resemble these points were recovered from the Medicine Lodge Creek site (Frison 1978:Figures 2.3 a,b). The level at Medicine Lodge Creek in which these points were found were dated at 8500 B.P. (RL-388).

The Cody Complex

Two Cody complex projectile points (#'s 18, 0) included in the Lawrence collection are shown in Figure 2b and Figure 3. The point in Figure 2b is a Scottsbluff-type variant. The artifact is a shouldered point with straight blade edges and parallel comedial flaking. The dimensions are 66.65 mm long, 23.82 mm wide and 7.81 mm thick. The hafting element is heavily ground on the edges, and the basal edge is formed by a ninety degree snap break. This type of break and the lack of basil thinning could demonstrate that the point was rebased after the original base was snapped off. The material type is obsidian from Obsidian Cliff (see Figure 6 and Table 1).

The other Cody-complex projectile point (Figure 3) is possibly a large Scottsbluff-like projectile point. The point is broken in two places: one snap break occurred below the shoulders about 3 mm and the other is broken across the blade up about one-half the length of the blade. The total length is unknown, the width is 28.15 mm, the thickness is 6.74 mm. Grinding is present on the hafting element, and the flaking is comedial. The point's surface demonstrates signs of being heavily patinated, even on the broken surfaces. The material type is also from Obsidian Cliff (see figure 6 and Table 1).

Other Paleoindian Projectile Points

The projectile point (# 16) in Figure 2l resembles a Haskett type. The point is a lanceolate with the widest area on the blade approximately two-thirds of the distance from the base to the tip. The blade edges taper slightly from the widest area to the base and abruptly to the tip. The base is straight with base and hafting element grinding. The flaking is irregular parallel-oblique. The material type is obsidian from Teton Pass or Fish Creek (see Figure 6 and Table 1).

The projectile point (# 195) in Figure 2m is Plainview-like. It is nearly parallel-sided with slight shouldering on the edges approximately one-third up from the base. The base is concave, and grinding is apparent on the base and hafting element. The flaking is parallel oblique, and the material type is an obsidian from Teton Pass/Fish Creek (see Figure 6 and Table 1). The dimensions are 87.40 mm long, 28.54 mm wide, and 9.37 mm thick.

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Figure 2h illustrates what appears to

be a large bifacially flaked knife (# 72). The knife has a lanceolate-like shape, lenticular cross-section and convex edges with resharpening or retouching flakes removed near the tip on one margin. There is no grinding on the edges and the flaking is irregular parallel-oblique percussion and pressure. The material is obsidian from Targhee National Forest (see Figure 6 and Table 1).

A similar obsidian bifacially flaked knife is from Baker Cave III (10-BN-153) (Plew et al. 1987:Figure 12). This Late Prehistoric site is located within the Wapai lava flow in the Eastern Snake River plain near Minidoka, Idaho. The knife is approximately 15 cm long, 6 cm wide and 0.07 cm thick. A radiocarbon date from Baker Cave III is 930 $\pm$ 60 (TX 5368).

Another possible knife (# 85) in the Lawrence collection is in Figure 2k. This specimen exhibits a triangular blade with a contracting stem or hafting element. The base element is slightly concave and does not demonstrate basal pressure thinning except in the center of the base. There are instead signs of a snap break as if the base was purposely broken at this point. The flaking is irregular and the basal edges are heavily ground in the Paleoindian style. The material type is an opaque obsidian from Fish Creek II (see Figure 6 and Table 1).

MATERIAL SOURCES

Several obsidian sources (Figure 6 and Table 1) are represented in the Lawrence collection. These sources were identified with the use of x-ray florescence (see Kunselman, this volume). They include several sources called Teton Pass/Fish Creek south of Jackson Lake about thirty kilometers; Fish Creek II, an ignimbrite source located in the same area; Grassy Lake north of Jackson Lake a few kilometers; and Conant Pass, a few kilometers northwest of Jackson Lake. The last two sources are Obsidian Cliff in Yellowstone National Park and an obsidian source in Targhee National Forest in Idaho, called Bear Gulch, approximately 100 kilometers northwest of Grassy Lake.

The percentages of the obsidian sources found in the sample of projectile points are as follows: (see also Table 1) Teton Pass/Fish Creek 43%, Obsidian Cliff 31%, Targhee National Forest 1.2%, and Conant Pass 0.3%. Breaking the percentages down by time periods starting with the Late Paleoindian, these tabulations are reached: Teton Pass/ Fish Creek 41%, Targhee National Forest 25%, Yellowstone Cliff and Fish Creek II 16%. The Early Plains Archaic period has the following percentages: Teton Pass 52.9%, Yellowstone Cliff 23.5%, Targhee National Forest 11.7%, and Fish Creek II 0.5%. The Middle Plains Archaic has 75% Obsidian Cliff and 25% Teton Pass, while Late Plains Archaic is represented equally by Obsidian Cliff, Teton Pass/Fish Creek and Grassy Lake. Finally, the Late Prehistoric point was from Teton Pass/Fish Creek.

The people of the Early Plains Archaic and the Late Paleoindian periods seem to have used the southern sources more frequently with an inverse relationship of material represented the farther north the source. This trend could represent a southern influx of people into the Jackson Lake area, exploiting the southern sources but not needing to travel farther north after replacing their tools. This pattern could also relate to the quality of the stone sources. Personal observations of Obsidian Cliff obsidian suggests that the material has an abundance of inclusions that decreases the flaking quality. Perhaps the southern sources are a better quality. Not enough data exist on the material sources used by the peoples of the other time periods to draw conclusions of migration systems.

SUMMARY

The function of the sites seems to have been base camps located strategically on the Snake River and Berry Creek confluence and the Snake river delta area. The placement of these camps was such to provide an optimum amount of resources per area with an ideal and easily accessible route into the northern Tetons. This route, Berry Creek Canyon, is thought to be the preferred route because of the greater amount of archaeological sites located in the canyon. The main plant resource exploited in the area was blue camas *(Camassia quamash)*. According to Wright et al. (1980), blue camas meadows surrounded the Lawrence site on three sides. This could account for the dominant features (fire pits and fire-cracked rocks) at Jackson Lake sites and specifically at the Lawrence site. Ethnographic reports demonstrate the use of fire pits for processing camas bulbs into an edible and storable form (Downing 1968). Since camas is the major plant resource in the area, and considering the method of preparing camas, it has been postulated that camas preparation was an important or main use for the fire pits in this area (Wright et al. 1980).

Animal procurement in this area is suggested by the relatively large number of projectile points. Conner (1986) also suggests that animals enjoying the warmth of the hot springs could be mired down and killed. Harris (n.d.) postulated bighorn sheep were the most important component of the Mummy Cave fauna. They could also have been a more important animal resources at Jackson Lake.

Other resources such as steatite are found north into the Tetons. Obsidian and ignimbrite sources are located near Fish Creek and Teton Pass. Other locations of obsidian are Beaver Creek in Targhee National Forest, Grassy Lake, Conant Pass west of Grassy Lake, and Obsidian Cliff in Yellowstone National Park.

The earliest occupation of Jackson Lake is the Late Paleoindian cultures. Movement of these groups is shown by obsidian sources used in the manufacture of their projectile points. According to Conner (1986) all obsidian from identified sources collected during the 1985 Jackson Lake Archaeological Project came from Teton Pass, south of the park. According to the material sources represented in the Lawrence collection, most of the obsidian was coming from the south (Teton Pass/Fish Creek), with the second most abundant source from the northwest (Bear Gulch). This possibly suggests that the people were coming up from the Green River Basin or from the Snake River in Idaho. Since most Cascade-type points are concentrated toward the west along the Snake and Columbia Rivers, it seems likely that those cultural groups were coming from that direction and that western Wyoming was the eastern-most boundary of that culture.

The Early Plains Archaic side notched points from the Lawrence site also seem to be on the northeastern boundary of the Bitterroot/Northern side notched tradition or region. This is also seen when looking at the characteristically different Early Plains Archaic projectile points types farther east in Wyoming. Morphological differences could be caused by geological barriers such as the Wind River and the Absaroka Mountain Ranges.

Besides these observations, others have also postulated about the geographical boundaries of this point type and cultural movement into and from the

Northern Great Basin. Gruhn hypothesized that:

> ". . . the Northern side-notched point type appears toward the end of the Anathermal in assemblages from the foothills of the central mountains (Birch Creek rockshelters) and on the Snake River Plain (at Wilson Butte Cave). In the Birch Creek valley sites this point type overlaps briefly in distribution with Cascade points; at Wilson Butte Cave it occurs in association with Pinto points of Great Basin origin . . ." (Gruhn 1961:153).

Gruhn also describes the dominant point type found in the Altithermal deposits at the Birch Creek rockshelters. They were the large side notched point. Also in the same deposits were found examples of stemmed, indented base points "perhaps indicating the spread further northward of the Great Basin tradition" (Gruhn 1961:153).

Jennings et al. (1980) believe that the similarity of the Bitterroot points to some of the Great Basin series argues for the Desert Archaic extension into the Plateau area. Jennings et al. also believe that the younger age of the Idaho materials further suggests the extension of the Basin Archaic tradition into, rather than out of, the Plateau area. According to material sources (see Kunselman, this volume) for the Early Plains Archaic period artifacts Lawrence collected, it appears most of the material is also coming from the south: the Teton Pass/ Fish Creek area. This could also demonstrate a northward movement or a migration into Jackson Hole from either the Green River Basin or the Snake River Valley. Another indication for southern or Great Basin influence and influx into the area is the Middle Plains Archaic projectile point (Figure 5d) representing a Great Basin type of projectile point form.

In conclusion, the Lawrence site was centered in an area with a wealth of abundant resources. These resources, such as obsidian, fauna, and to a lesser degree flora, were important to the Late Paleoindians and also fully exploited by humans in later periods. With this information, one can assert that the Lawrence site and the Jackson Lake area was an excellent camping area during migration routes to exploit the seasonal resources. In addition, the use of X-ray florescence to identify material sources helps archaeologists to better understand past migrational and settlement patterns.

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BOOK REVIEWS

Objects of Change: The Archaeology and History of Arikara Contact with Europeans. By J. DANIEL ROGERS. Smithsonian Institution Press, Washington, D.C. 1990. 228 pp., appendix, references cited, index. $29.95 (cloth).

In *Objects of Change*, J. Daniel Rogers examines relationships between social change and material culture during the contact situation between the Arikara Indians and Euroamericans. The Arikara were a group of sedentary horticulturalists, closely related to the Pawnee, living along the Missouri River in what is now North and South Dakota. They served as middlemen in both a prehistoric trade network and the historic fur trade network.

The book is divided into nine chapters, with a long appendix containing the raw data on which the statistical analysis is based. The introduction outlines the goals of the analysis and the types of data (ethnohistorical and archaeological) used. This is followed, in Chapter 2, by an outline of the authors "theoretical" position(s). Rogers argues that most studies of interaction and contact have been ethnocentric and have assumed that new technology and other trade items were uniformly adopted because of technological superiority. Here, Rogers argues that this is not so, but that interaction is variable. The differential adoption of trade items is best understood in terms of the cultural values of the group acquiring the items. In other words, we must understand something about the relationships of material culture, social organization, cosmology, and symbolism of the group being studied.

Chapter 3 reviews the Arikara cosmology, ceremony, social organization, subsistence, economic organization and their first encounters with Euroamericans. Chapter 4 discusses both Arikara and Euroamerican perspectives on trade. The trappers and explorers looked largely at trade from the economic, profit-making perspective. The Arikara used trade and gift-giving for establishing and solidifying social relationships. Chapter 5 then reviews the history of Arikara/Euroamerican contact and defines six chronological periods from precontact times in the late 1500s to 1862. During this interval, the Arikara went from a thriving horticultural group occupying 13 villages to one village combined with the Mandan and Hidatsa. They also became completely dependent upon the United States Government for food. Their population and social order was decimated by epidemics.

Hypotheses which relate changes in material culture to the social changes occurring during the interval under study are outlined in Chapter 6. Rogers defines five artifact processes that should occur during different types of social change. These are maintenance, addition, replacement, rejection, and transformation. Expectations are then outlined for those processes that should occur for each time period in three archaeological contexts: domestic earthlodges, ceremonial earthlodges, and burials. Procedures used for selecting sites and features for inclusion in the analysis and classification procedures for aboriginal and Euroamerican artifacts are the topics for Chapter 7. One hundred sixty-four artifact types are organized into 25 activity sets, with the recognition that an artifact type can be used in more than one activity set.

The actual data analysis is presented in Chapter 8. Rogers first looks at changes in the average number of activity sets per feature for each context. Because of sampling difficulties, most of the analysis focuses on domestic earthlodges. Rogers then looks at continuity of aboriginal and Euroamerican artifact categories over the same period. Q-analysis is used to examine the structure of the assemblage. For the most part, the original hypotheses are confirmed. Maintenance, addition, and replacement of artifacts characterize periods of social cohesiveness; rejection and transformation occur during periods of stress. More change occurs in artifacts unrelated to production, e.g., personal adornment, than in artifacts used for basic production, e.g., cutting, scraping, containing, etc. Chapter 9 provides a summary of the investigation and a discussion of the complexity of material culture.

Rogers' analysis is interesting and thought-provoking, with good points about the ethnocentrism of many earlier analyses. Still, I do not find the data analysis all that convincing. I wholeheartedly agree with the statement that the data base may not be suited to complex statistical analysis. But more importantly, the significance of change from one period to the next needs to be evaluated. In other words, is an increase/decrease by one or two artifact categories significant, or due to chance? I also wonder if the decrease in Euroamerican artifact categories can really be interpreted as rejection, when all artifact categories decrease. Both Arikara and Euroamerican artifacts seem to undergo the same changes, perhaps suggesting a sampling problem, size/diversity relationships, or other cultural factors that might account for the observed variation. The most glaring weakness of this volume is the lack of theory to relate social and material culture changes. Other than assertion, Rogers offers no arguments to link the different artifact processes to different types of social change. It is something of a "shoot from the hip" approach, which Rogers himself criticizes.

Objects of Change will be most useful to scholars of acculturation with a strong statistical background. This book is not light reading; there is too much jargon; many chapters are redundant; and the statistical analyses are difficult to follow. Nevertheless, Rogers raises many important issues. It is a goal of archaeology to relate material culture to social processes. Other investigations have not even attempted this. Rogers' study should be commended for that effort. *Objects of Change* may not answer many questions. It can, however, provide a basis for generating models and building theory to account for cultural changes in aboriginal/Euroamerican contact situations. If it starts a few more of us into thinking about the social meaning and context of artifact types, this book will serve a valuable function.

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